Railway Mechanical Engineer

January 1942

FOUNDED IN 1832

Published monthly by Simmons-Boardman Publishing Corporation, 1309 Noble Street, Philadelphia, Pa. Entered as second-class matter, April 3, 1933, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription price, $3.00 for one year, U. S. and Canada. Single copies 35 cents. Vol. 116, No. 1.

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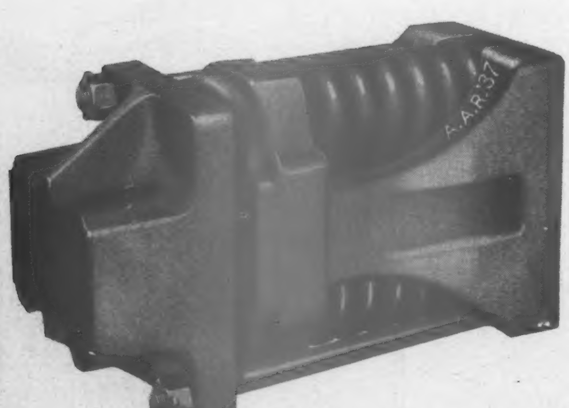

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RAILWAY
MECHANICAL ENGINEER

The Mechanical Engineer and

Defense Transportation

"How Can Mechanical Engineering Assist Railroads in the National Emergency?" the subject of addresses and discussion at the Railroad sessions of the A. S. M. E. annual meeting

IN a symposium dealing with the transportation phases of the national emergency, conducted during the annual meeting of the A. S. M. E. on December 4, 1941, under the sponsorship of the Railroad Division, many problems of substitution and reclamation of materials to meet the shortages of supplies available for civilian use were discussed, and ways in which the mechanical engineer can assist the railroads were suggested.

Both morning and afternoon sessions were devoted to the symposium, the former under the chairmanship of A. I. Lipetz, consulting engineer, American Locomotive Company, and chairman of the Executive Committee of the Railroad Division, and the afternoon session under the chairmanship of William H. Sheehan, assistant vice-president, sales, General Steel Castings Corporation, a member of the Executive Committee of the Railroad Division and chairman of its Meetings and Papers Committee. The morning session was addressed by William C. Dickerman, chairman of the board, American Locomotive Company, and Col. C. D. Young, vice-president in charge of real estate, purchases and insurance, Pennsylvania. The afternoon session was addressed by Ralph Budd, president, Chicago, Burlington & Quincy, and at that time commissioner, Transportation Division of the Advisory Commission, Office for Emergency Management, and Charles H. Buford, vice-president, Operations and Maintenance Department, A. A. R.

In this article are presented summaries of the addresses and discussion.

Budd Emphasizes Need for Standardization

Suggests bringing out designs of a few types of steam locomotives which will provide for all conditions

Ralph Budd

"Two different spheres of activity have been suggested within which you can assist in the defense effort," said Ralph Budd, in opening his talk at the beginning of the afternoon session. "The first is through more rigid standardization of equipment and the second is through the use of substitute materials instead of those ordinarily used, but now needed in other defense work. The two ideas are seemingly contradictory and in some respects they are. Standardization is a normal and continuing process, while substitution to a large degree is of an emergency character and we sincerely hope quite temporary. Standardization makes for uniformity of shape and sizes; substitution does the opposite. Standardization increases economy and efficiency, while with some exceptions substitution results in higher costs and less efficient operation. The common and compelling factor is the present national emergency and the consequent necessity to use as little scarce material as possible and in the way which will enable mills, factories, car builders, and locomotive builders to work to best advantage. The dual character of this appeal to the ingenuity and skill of mechanical engineers should be kept in mind in considering the extent to which normal engineering procedures may be modified during this abnormal period."

Cites Railway Record in Car Standardization

Continuing his discussion of standardization, Mr. Budd pointed out the large number of parts of freight cars which have been standardized. He listed 12 parts or dimensions of parts of trucks, 17 parts, materials and fastenings of car bodies, and 12 others applying to box cars only, which are now standard, and emphasized the importance with which he regarded the reduction to a small number the different types of freight cars, which the railroads have accomplished through the Association of American Railroads. Orders for small lots of cars, he said, would be added to other orders of substantial quantity placed by other railroads for similar equipment, and that an order of 1,000 cars or less should not be placed with more than one builder. When necessary, he said, odd sizes of plates and shapes will have to be used and that the railroads had agreed to this, even though he understood that it would add approximately 350 lb. more steel per car.

"The ideal locomotive assignment on a large railroad," said

Mr. Budd, "is to have the capacity of the locomotive so adapted to the grade line that the heavier power on the steeper grade districts will permit the handling of a train of uniform tonnage the entire length of the line. In other words, the locomotives serve to flatten out the humps and hollows of the grade line. This has been worked out with great success on some of the trans-continental routes with the result that on one large road, for example, a 5,000-ton train is handled from the West Coast to the Great Lakes without double heading and by using helper engines only in the mountains. The sole change in tonnage coming across the country is in filling out to 6,000 tons on the last 500 miles of the run across the prairies. Locomotives which are best adapted to a particular railroad might not be best suited to other transcontinental lines or to the shorter railways, but the problems there presented are generally similar."

Mr. Budd suggested that it should be possible to bring out designs of steam locomotives which would eliminate all but a few types and provide the necessary tractive force and speed for almost any circumstance. An impartial study along these lines he considered to be feasible and desirable, perhaps to be conducted by the locomotive builders.

"The variety of sizes and other characteristics might follow somewhat the idea which has been worked out in the field of Diesel-electric locomotives in order to get the benefits which come from mass production," he said.

A National Aspect of the Problem of Materials

Although it is a matter about which Mr. Budd did not believe mechanical engineers can do anything, he mentioned the importance of allocating "enough material to our transportation facilities to keep them in good condition and to make such additions as are necessary to handle the increasing traffic." In the narrower sense of doing the best with what they have, he said that the transportation agencies needed no defense, that the record spoke for itself. "The broader problem of doing the best with what we as a nation have at our disposal," Mr. Budd continued, "is one of ultimate policy. A part of that policy is to say how much shall be assigned to transportation. Obviously, it would not be making the best use of what we have if transportation, which is now in balance with production, should be thrown out of balance by denying it needed material and assigning so much to the production of other things that, when produced, they cannot be transported."

What Other Forms of Transportation Are Doing

Reviewing the situation of the five forms of transport, Mr. Budd said that the railroads, which handle about two thirds of the nation's tonnage, owned 1,641,540 freight cars on October 1, 1940, and 1,675,630 on October 1, 1941. The railway industry, he said, felt that it should be allocated enough material to keep up the existing plant and increase freight-car ownership to 1,800,000 cars by October 1, 1942. This, he said, would require the building of about 154,000 cars during the twelve months and the locomotive program called for about 1,000 locomotives in the same period. "Work on the new car and locomotive programs is being delayed by shortage of material," he said.

Highway trucks are handling more traffic than ever, he said, and the production of more than one million trucks is planned in 1942, and he believes they will be needed. Buses, he said, are the hardest hit of any public carrier. The elimination of aluminum lost a large part of the early deliveries in 1941 and using this exceptional period as a standard is working a great injustice in the allocations for 1941 and 1942. "The need of more bus service in many localities and plants on account of national defense activities," Mr. Budd continued, "is very great and it is hoped that recognition will be given that industry in the public interest."

Automobiles, he said, account for perhaps 90 per cent of all passenger miles. There are about 28,000,000 of them and production in 1940 and 1941 will be about 7,000,000. About half of the use is considered to be for business and half for pleasure, he said.

Down the Great Lakes, on which about 80 per cent of inland waterway tonnage is handled, approximately 80,000,000 long tons of iron ore will have moved during the 1941 season. Building 20 or more boats has been authorized, he said.

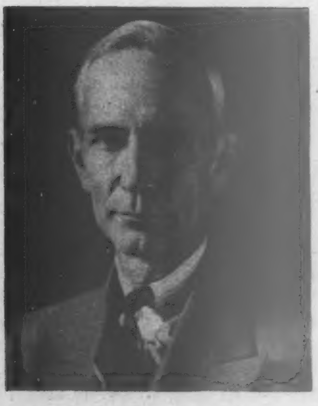
Pipe-line traffic is increasing and Mr. Budd said that the only pipe line which has been denied material is that from Texas to the New York area.

Commercial airways, he said, will be allowed to add 228 transport planes, 112 of which have been assigned to the various operating companies.

"Making the best use of what we have," Mr. Budd concluded, "cries out for a broad impartial survey and the adoption of a wise policy. This would lead to a balanced production in which no type of transportation will be favored, or slighted, or forgotten."

Cautions Against Too Rigid Standardization

Colonel Young urges exercise of generous amount of common sense and ingenuity in the emergency



Col. C. D. Young

"My remarks," said Colonel C. D. Young in opening his discussion, "deal almost entirely with the old adage which admonishes us to cut our suit according to the cloth at hand.

"You are probably all aware of the opinion generally held by the average layman that the mind of the engineer is almost completely inflexible. As an engineer myself, possibly I have been guilty of some uncomplimentary thoughts about the inability, or at least reluctance, of the fraternity as a whole to change with changing economic conditions.

"While wholeheartedly favoring adherence to standards which have been adopted as the result of years of experience in research I want to emphasize the fact that a national emergency compels us to use a generous amount of common sense and ingenuity in the way we apply the results of the work of this body and of other engineering societies." In the emergency Colonel Young commended to engineers generally the Army concept of engineering, quoting several excerpts from training regulations and army manuals as illustrations. Thus:

"The guiding thought of a military engineer engaged in road or bridge work should be that expediency is the rule and standard civilian practice the exception.

"Permanent construction beyond apparent needs is not sought, although a fair degree of permanency is often attained through the necessity of making the work strong enough to bear military loads and durable enough to keep maintenance within reasonable limits."

Again, under Construction in War:

"Construction duties place on engineer officers the heavy responsibility (as well as the disagreeable duty, at times) of limiting the use of materials to the bare necessities in order to economize, not only on the materials themselves, but also on the transportation needed to haul them."

From the basic field manual, Colonel Young quoted the following as to the engineer's personal qualifications:

"Every effort should be made to increase interest by the employment of training expedients.

"The success of engineer missions will often depend upon your own engineering skill, knowledge, initiative and resourcefulness."

Limited Number of Designs, as Applied to Freight Cars, Not Practical for Steam Road Locomotives

In discussing standardization Colonel Young commented on the fettish which those outside of the railroad industry make of standardization of equipment in the national emergency, urging that standards be established, followed blindly. He pointed out that the number of designs of freight cars from which orders will be placed had been greatly reduced by the Association of American Railroads. "I do not believe," he said, "that this theory, when applied to steam road locomotives, is as practical and sound on account of the varying conditions of topography and restricted clearances on the different railroads in different sections of the country; and it is, therefore, not entirely practicable to use the same sizes or weights of locomotives on all railroads without interfering with efficiency of operation.

"However, I believe that during the national emergency the practice heretofore followed by many railroads of purchasing small lots of steam locomotives to individual designs should be discontinued. Not only should no new designs be started during the period of the emergency, but small locomotive orders should be consolidated into larger lots of a single existent design which would make speedier and more economical production. We could thus avoid new dies, fixtures, patterns, etc., as well as the time that would be consumed in engineering manhours for each particular new design."

Colonel Young pointed out that at the present time, because of the difficulties experienced in securing planned schedules for equipment and maintenance needs, substitutions have been made on the railroad with which he is associated, "practically none of which could have been accomplished without the initiative and resourcefulness of practical engineers in charge of the work." As examples he cited the substitution of cast iron for steel in specific cases; the substitution of plain carbon steel for copper-bearing steel; the substitution within proper limitations of Bessemer for open-hearth steel; the acquisition of surplus steel ingots made for a foreign government (but not exported) and arranging for the rolling of them into car plates. He referred to the use of welding in place of riveting as an example of changing methods of construction which have been done wherever necessary.

In passenger-car work he said that substitutions of plastics had been made in trimming and interior fittings because of the scarcity of other materials, and that these seem likely to become permanent after the present emergency. "Intensive research," he said, "is necessary under these conditions in order that the engineer may have the proper background to determine in his own mind how far he may go in changing his practice as to materials and design to obtain the equivalent essential to the service. Research at this time should be continuously looking forward to that day when time and labor may be saved in plant improvement that there may be a cushion some time in the future when the present activity of war construction and manufacture has suddenly been cut off. If this work is intelligently done now, it will pay dividends in the future."

Colonel Young referred to the Bureau of Industrial Conservation which is under consideration for inclusion within O. P. M. It might well, he said, attack obsolete and uneconomical municipal codes and regulations.

"There is, as you know," he said in closing, "a stormy gulf between the complacent procedure of peace-time operations and the powerful drive against time which war thrusts upon us—a gulf which is not crossed without discipline and skill. With the conditions under which we are now living most of our former objectives must be forgotten—in fact, so completely forgotten that no pressure from any class or group will make us hesitate in taking up the new line of work, meeting frankly and courageously the mental and physical confusion which inevitably follows a change of this magnitude and then turning that confusion into orderly efforts along new lines.

"The changes will affect the different industries in varying degree. It is probable that they will be least violent for the utilities, communications and rail and highway transportation. For those industries the change will be chiefly in providing for increased volume of business.

"The correct solution of any problem depends upon a true understanding of what the problem really is. In this case, it must be understood correctly by a large number of people—in fact, all industry must have a common understanding of the things we are working for."

The Next Year's Freight-Car and Locomotive Needs

W. C. Dickerman discusses probable increases in traffic volume—Doubts that materials to build all equipment needed will be available

W. C. Dickerman

William C. Dickerman made a broad survey of the probable needs of the railroads for freight rolling stock and motive power, to meet prospective traffic requirements in 1942. After a careful study of the various estimates of national income and industrial production made by experts in government as well as private agencies, Mr. Dickerman said "we believe that the index of industrial production may approximate 156 for the full year of 1941, and average in the vicinity of 175 in 1942. This would represent an increase of 12 per cent in 1942 over the average for 1941."

"National income in 1941 is estimated to be 19 per cent above 1940, and in 1942 it is expected to increase 17 per cent over 1941. Part of the estimated increase for 1942 is based on an anticipated increase in the general price level. An estimate of 1942 national income, in terms of 1941 prices—showing a gain of 7 per cent—may not be too far off.

"Now let us examine the carloading picture with these estimates in mind. It seems indicated that total carloadings in 1941 will be about 42 to 43 million, or about 16 to 18 per cent above the 1940 total. And in 1942, the total would be between 46 and 47 million, roughly 10 per cent above the 1941 figure."

Material Needed for New Freight Cars

In estimating the number of cars needed to carry this load, Mr. Dickerman referred to the program of 1940 to increase total freight ownership from 1,646,000 cars on July 1 of that year to 1,700,000 by October 1, 1941, which fell short of the goal by about 24,000 cars because of the shortage of materials, and cited the further proposal made early in 1941 to increase freight-car ownership to 1,800,000 by October 1, 1942, calling for 100,000 more new cars than were included in the proposed 1941 ownership. To this he added the shortage of 24,000 cars in the 1941 program and an additional 30,000 cars to take care of retirements during the coming year, making a total of 154,000 new cars required to meet the October 1, 1942, goal. The requirements of materials (in tons) for 154,000 freight cars he set forth as follows: Plates, 827,750; shapes, 654,500; sheets, 223,300; bars, 84,700; forgings, including axles, 327,250; steel wheels (one-half), 207,900; cast-iron wheels (one-half), 231,000; steel castings, 554,400; all other materials, 277,200—a total of 3,388,000 tons of material, including 554,000 tons of steel castings. "In view of the great need for steel castings in connection with the manufacture of ordnance," said Mr. Dickerman, "finding and allocating this requirement is going to be a real job."

"During the first ten months of 1941 the average number of cars installed monthly was about 6,500. In October it was nearly

9,000. Now, if the October rate, which is the highest to date, is not stepped up during the remaining eleven months, we may expect a shortage of at least 45,000 cars in the programmed ownership of 1,800,000 cars on October 1, 1942. And if the average is no better during the next eleven months than it has been during the first ten months of this year, then we may expect the program to fall short of the goal by 75,000 cars."

A Minimum of 1000 Locomotives at Home — Over 300 for Export

Taking up the need for more motive power, Mr. Dickerman said that it was extremely difficult to use "an overall ratio" between the number of freight-car loads and the number of locomotives required, and that definition of future requirements for additional locomotives must depend upon the requirements of the individual carriers. He also reminded his audience that the defense program has "broadened the locomotive building industry's structure to include the building of tanks, gun carriages and other articles of ordnance and defense." This burden, he said, must be borne in mind in any projected plan of locomotive building.

"Total October shipments of 104 units, including exports, from manufacturers and railway shops were higher than any month this year," he said. "On November 1 of this year the total backlog of locomotives ordered and undelivered including railway shops, was 985 units. Of these, 311 were domestic steam locomotives, of which 267 were on order with manufacturers. Under present manufacturing conditions this represents a substantial part of available shop capacity.

"On November 1, 1940," said Mr. Dickerman, "unfilled orders totaled 295 locomotives, of which 137 were domestic steam locomotives, including 125 on order with manufacturers. And foreign orders this November totaled 77, compared with 26 last year.

"The number of locomotives available for service increased from 35,243 on November 1, 1940, to 37,530 on November 1, 1941, which represents a gain of 2,287 units. During the same period locomotives actually in service increased 2,803 units, going from 33,126 last year to 35,929 on November 1 of this year."

Pointing out that on November 1 last, there were 2,377 fewer locomotives awaiting repair than a year earlier, Mr. Dickerman thought that a large number of the 3,778 remaining unserviceable units were old locomotives which could not be repaired satisfactorily and said a survey would be required before a definite judgment could be formed. He said that "it now looks as though the minimum number of locomotives which builders will be asked to deliver in 1942 would total 1,000—half steam and half Diesel-electric. This means that orders for steam locomotives will have to be increased by about 200 units, since the backlog now numbers only a little over 300 units, many of which will be delivered by December 31. Orders for new Diesel-electric will probably not be particularly large, since the backlog is more than 500 units.

"In addition to supplying domestic requirements, it already appears that the builders of steam locomotives will have to provide for more than 300 units for export. Of this number, 33 will go to the Mexican railroads (with American Locomotive and Baldwin Locomotive each supplying about half). There will be 20 units for the Yunnan-Burma Railway (supplied by American Locomotive) and up to 250 for export under Lend-Lease provisions. These will probably be used in Egypt, filling the deficit left by motive power shifted to the Near East for transporting war materials to Russia. And the materials for manufacturing these units might receive priority over domestic requirements."

In considering the course of future action, Mr. Dickerman said that, first, was the "absolute necessity for immediate and continued, complete and unselfish-cooperation of all concerned with transportation, and, second, the necessity that materials be made available on schedule to the equipment builders. He expressed doubt, however, that all of the materials needed would be available and that we must learn to do "the best we can with what we can get and with what we already have."

Speaking of 1943, Mr. Dickerman said that traffic conditions then are largely unpredictable but he believed that the burden would undoubtedly increase over the 1942 level if the war continues. "And one possible solution of the situation at that time," he suggested, "may be not merely the freezing of locomotive designs, but the restriction of designs that will be made available. This is a likelihood which all of us should be turning over in our minds now."

Buford Discusses War-Time Standardization and Post-War Competition

New fleet of cargo ships and expanded airplane-building capacity among war-created conditions affecting roads after peace is restored

C. H. Buford

Charles H. Buford recalled reports of meetings of railway mechanical officers which were held more than 70 years ago following the civil war.

"As a result," he said, "we have the standard gage of track on the American railroads, and for more than 70 years groups of engineers from many railroads have been conferring and working together to bring about uniformity and interchangeability in parts of railroad cars and other facilities. The results of their efforts are evidenced by the free interchange of equipment which prevails in this country today."

There is, he said, a constant urge to continue the program of uniformity commonly called standardization. He considered the word "standard" unfortunate, however, because most people think that it refers to something which will not or cannot be changed. "My conception of a standard of today," said he, "is the accepted or established rule or model of today and railroads should and will change models wherever necessary to improve the railroad plan. This flexibility in railroad methods is absolutely necessary and will be readily apparent to you from some recent tests of axles for freight cars."

He referred to tests of a hollow axle which suggested to him that it might replace the solid type and that it might be found possible to develop an axle of uniform outside diameter, by varying the thickness of the walls, for cars of, say 50 and 70 tons. The bearings would then be interchangeable for different capacity cars which he thought should reduce manufacturing costs and store stocks.

Such a change he said would be made only after exhaustive laboratory and field tests had proved the merits of the new type "because the railroads place safety above everything else."

Roller Bearings for Freight Cars

"When I speak of the possibility of a standard size bearing for a standard outside diameter hollow axle for freight cars," continued Mr. Buford, "some of you no doubt wonder if I am referring to a roller bearing for freight cars. I know some people are asking why the railroads continue the use of friction bearings on freight cars, and they are invariably referring to an advertisement that recently appeared in newspapers and magazines which broadcast much misleading information. Among the statements made was one to the effect that present freight cars are obsolete and that the railroads propose to build many more thousands of obsolete cars, and all that is needed to modernize the fleet of 2,000,000 railroad and privately owned cars is to put roller bearings under them.

"A change from friction to roller bearings for freight cars is a change in a standard and deserves consideration by mechanical

men because of the publicity given the question and the implication that the change should be made at once."

Mr. Buford questioned that there would be any considerable advantage in roller bearings at train speeds of 80 to 100 miles per hour and took up the effect of roller bearings on freight yard operation.

"The movement of a car on a track with a descending grade," he said, "is governed by the force of gravity, weight of the car, the speed at the start, friction of bearings, and other resistances and the degree of slope of the track. The temperature at the time the move is made is of importance with friction bearings. All of these elements are considered, and hundreds of millions of dollars have been spent in this country for building yards that are properly designed for manual or mechanical control of cars while being switched. Millions of dollars are spent annually to maintain these yards with tracks on the proper grades to best handle the switching of cars with friction bearings. Many expensive changes would have to be made in railroad switching yards before we could consider the universal use of roller bearings under freight cars. In fact, as the plant stands today, it appears to me that if you could wave a magic wand and put roller bearings under freight cars right now, the entire railroad plant in this country might be seriously crippled within 48 hours."

Mr. Buford referred to the suggestions that the railroads have a standard car and a standard locomotive and that they redesign parts of the equipment so as to minimize the use of certain critical materials such as nickel. He told of the proposal of the Car Construction Committee approved by the General Committee of the Mechanical Division that during the emergency the railroads adhere to a limited number of selected types of box, auto-box, hopper, gondola and flat cars,* which has been adopted by the A. A. R., and pointed out the impracticability of a standard steam locomotive because of differences in physical characteristics of operating territory, clearances, load limits, fuel supply and traffic. "This situation has been met, however," he continued, "by the General Committee of the Mechanical Division unanimously agreeing that during the emergency, locomotives should be built only to existing designs where the engineering is completed and where patterns, dies, etc., are already available. The locomotive builders will contribute to this program by the exchange of plans, engineering data, and patterns, and will fabricate for each other material entering into locomotive construction in order that maximum locomotive output be obtained."

Mr. Buford said that the railroads had been told to figure on the bulk of the steel for freight cars in sheets 48 in. wide and under with a limited tonnage probably available in 60-in. and 70-in. widths. The Committee on Car Construction has analyzed various designs, he said, and prepared detailed sketches showing a recommended method of construction using plates not wider than 48 in. which have been approved by the General Committee of the Mechanical Division and are being sent to members and car builders so all interested parties will understand how to utilize these sheets.

Among the critical materials, a shortage of which has created problems for the railroads, he cited nickel steel which will no longer be furnished for the construction of new riveted boilers. He said that the railroads would use carbon steel for new locomotives during the emergency, but that consideration would be given to building a few more fusion-welded boilers if material can be obtained and the Interstate Commerce Commission approves. A supply of low-carbon nickel steel for locomotive bed castings, axles, rods, motion work, and other items for both repairs and new construction, and steel plates and rivets for repairs on existing locomotive boilers constructed of nickel steel, he expects to be available to the railroads.

He said that the railroads had also considered the substitution of wood and the increased use of various alloy steels in freight-car construction; the wood offered no advantage and it is impossible to obtain the alloy steels for building freight cars.

Effect of the Emergency on Post-War Railroads

"The temporary conditions facing us call for thought as to what mechanical engineers can do to help the railroads, not so much in the present emergency as to what they can do to help the railroads meet conditions after the emergency is over," said Mr. Buford in conclusion. "Consider what is happening today. Our government is building an enormous fleet of cargo-carrying vessels. Is it not probable that they will be operated in coastal and intercoastal service, with or without government subsidy, after this war?

"The government is financing a tremendous expansion program for the construction of facilities to manufacture airplanes. Is it not likely that after the war these facilities will turn to the production of commercial airplanes and that the planes will be maintained by government subsidy?

"A move is now under way to get national legislation that will take from the states the right to specify the weight and length of loads that can be hauled over their highways. This is designed to permit more profitable operation of privately owned commercial vehicles on the highways.

"I am not giving you this picture for the purpose of debating the merits of the case, but rather to indicate to you that the railroads will have a real problem after this emergency is over. If they continue to function as a private industry, which they certainly should do, they must provide cheaper transportation to meet the kind of competition to be expected."

* A list of the proposed designs is set forth in an article on page 512 of the December, 1941, issue of the *Railway Mechanical Engineer*.

A Summary of The Discussion

Of more than a dozen speakers that took part in this forum the idea of the necessity of using existing car and locomotive designs for the new equipment of the immediate future was expressed by half of the participants. In outlining the value of this idea Ralph Johnson, chief engineer, Baldwin Locomotive Works said in part, "as the emergency requires speed in expanding facilities one of the most logical ways to accomplish this is to confine purchases to existing designs. If future orders are placed as duplicates much engineering time could be saved in addition to the use of existing patterns and dies. A new locomotive design requires an average of 30,000 man-hours even for an experienced builder and when the time of the railroad mechanical department is added to this it can be seen that a large saving in time as well as money can be made by using existing design." Mr. Johnson also joined with other speakers in suggesting substitutions for increasingly scarce materials and added further the idea of eliminating the use of devices on locomotives which have not proved their ability to influence performance favorably and to add such devices as are known to increase locomotive efficiency.

In the field of locomotive design and utilization, K. Cartwright, mechanical engineer, New York, New Haven & Hartford, suggested the value of recounterbalancing many of the older locomotives in accordance with recently recommended practices. "Many locomotives," said Mr. Cartwright, "that under normal conditions would be considered obsolete are being put back into service to meet emergency demands. The use of these locomotives in main-line service in many cases obstruct the flow of traffic because they cannot be operated at today's speeds without causing damage to track. By taking advantage of the information now available these locomotives can be rebalanced at small cost so that they can take their place in modern main-line operation." R. M. Ostermann, Superheater Company, said that the wish for a more complete standardization of steam locomotives could only be fulfilled through departure from the present conventional design; by building a steam locomotive with considerably altered horsepower-speed characteristics. Mr. Ostermann visioned such a locomotive as one with mechanical drafting as well as firing; one in which the prime mover would be geared to the drivers and one in which a large enough percentage of total weight is carried on the drivers to permit the development of maximum tractive force without slipping.

John M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission, emphasized the value of maintaining the standards of safety and pointed out that a high standard of locomotive condition has been responsible for the ability of the railroads to do the job that has already been done. Referring specifically to the practice on some roads of patching up, Mr. Hall cited an experience during the last war wherein

(*Continued on page 19*)

Measurement of

Stresses in Car Wheels

By Reid L. Kenyon and Harry Tobin*

Part II†

Technique of the Rosette Method

THE practical application of the rosette method to the study of stresses will always involve problems peculiar to the particular type of structure under consideration. This is especially true in the case of railway car wheels due to their complicated section.

The theoretical limitations of the method are as follows:

(a) All deformation must be elastic;

(b) The results are strictly correct only on plane surfaces because the theory is based on the condition of "plane stress." However, close approximations can be made on surfaces of very slight curvature if the gage length is short.

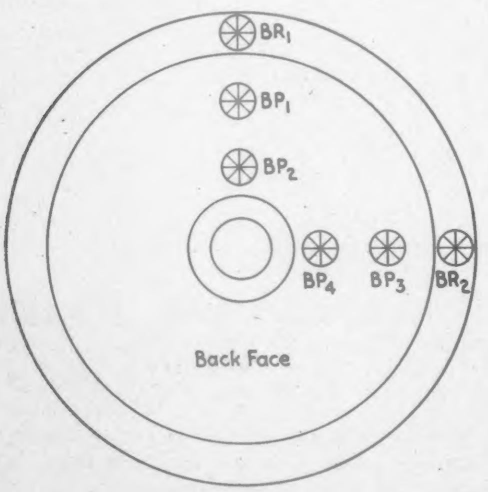


Fig. 8

There are two kinds of stresses of interest in wheels: those present as the result of the treatment of the wheel previous to examination, and those that may result from subsequent treatments. In both cases rosettes are placed at the locations where the condition of stress is to be studied and a complete set of measurements of all gage lines is taken. In the first case the rosettes must then be cut out to relieve them from the restraining effect of the surrounding metal and a second set of readings taken after the initial stress condition has been relieved by the cutting. This is a destructive test. In the second case, however, the wheel is subjected to the desired conditions of test or service and after or during this subsequent treatment, further readings of the gage lines are taken and thus the "change in stress" resulting from the subsequent treatment is determined.

In selecting locations for the rosettes on the wheels the greatest interest will usually be at the points of highest stress. Due to the design of the wheels this is in the plate or web section. There is no limit to the number of rosettes that can be placed on the wheel but actually it is necessary to use only a very few to study the critical stresses. Rosettes BP_1 and BP_2 located on the back face of a wheel as shown in Fig. 8 and corresponding rosettes FP_1 and FP_2 (not shown) directly opposite them on the front face will determine the highest stresses usually found in the plate of a wheel. This statement is based on extensive explorations made, during the past five years, of stresses at various locations in wheels. These rosettes are located as near as possible to the hub and rim fillets without departing from the essentially flat portion of the plate of the wheel. Radial measurements across the fillets should be avoided due to the errors which they introduce.

When the faces of the rim are wide enough a rosette BR_1 is placed on the face of the back rim in a radial line with plate rosettes as shown in Fig. 8. A corresponding rosette is placed at FR_1 directly opposite on the front face.

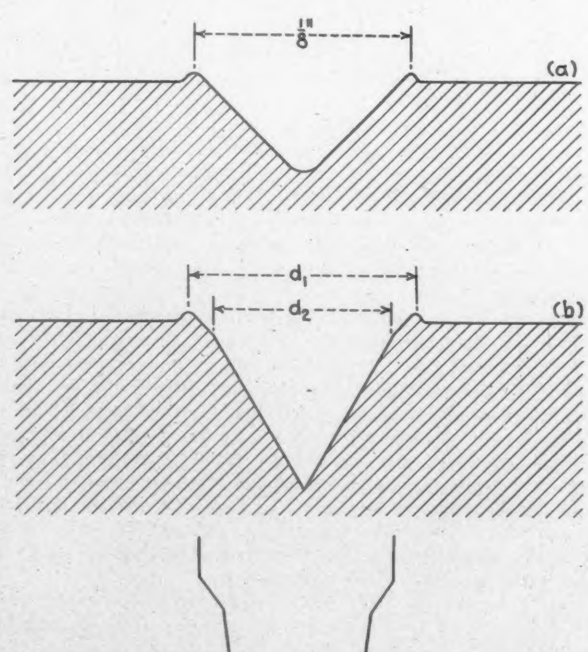


Fig. 9

* Associate director and research engineer, respectively, Research Laboratories, The American Rolling Mill Company, Middletown, Ohio.
† Part I of this study appeared in the December, 1941, issue.

A duplicate set of rosettes BR_2, BP_3 and BP_4 is generally located 90 deg. from the first set as shown in Fig. 8 and of course corresponding rosettes FR_2, FP_3 and FP_4 are placed opposite these on the front face. Additional sets of rosettes can be added and they are frequently placed in four positions 90 deg. apart. Unless variation in the magnitude of the stresses at different points around the wheel is suspected it is rarely necessary to use more than two sets.

The rosettes can, of course, be applied to any essentially flat surface of the wheel. For example, in some studies, we have placed rosettes on the tread and determined the initial stresses by making measurements before and after cutting out the rosettes.

When wheels have a thin layer of martensite on the tread due to brake action a small hand grinder has been used to grind "spots" through the hard skin so that punch marks could be made in the underlying metal in the regular manner. Some error is probably introduced depending on how deep the gage marks are located under the "extreme fiber."

The method of making the gage marks for the rosettes has an important effect on the accuracy of the results, and depends on the type of strain gage used. Although, as

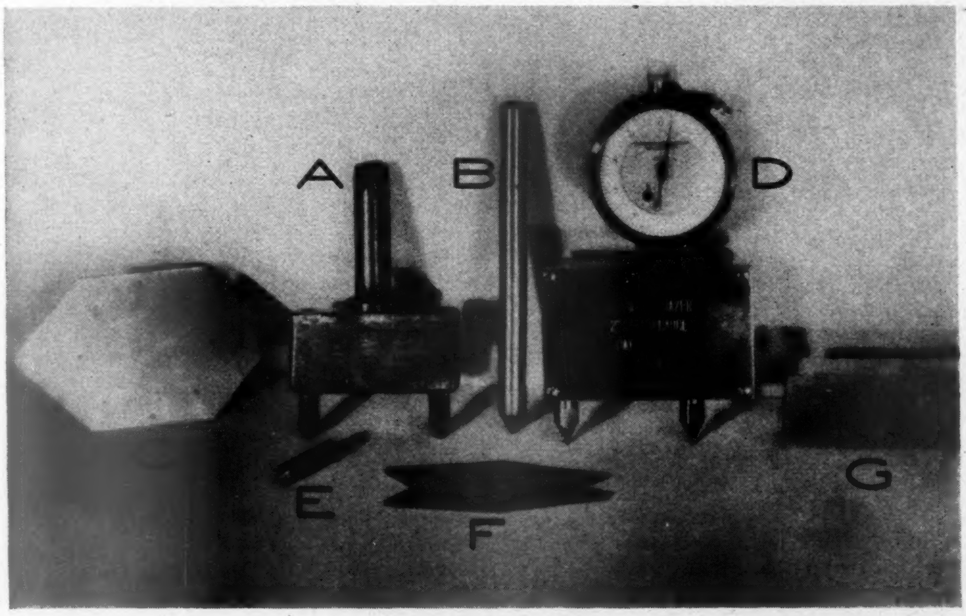


Fig. 10—Special tools required for making punch marks on wheels and for measuring rosettes

Fig. 11—Method of using strain gage in measuring a rosette on a car wheel

Fig. 12—Measuring the temperature of the wheel near the rosettes

far as the application of the rosette theory is concerned, any accurate strain gage can be used, in most wheel studies we are forced to use a removable or "hand-held" gage. This makes it necessary to establish fixed reference points which can be maintained undamaged during the course of a test or during subsequent treatments.

We have found it advantageous to use a gage in which the movable point moves so as always to be parallel to the fixed point. This avoids any variation in angularity of the points as they enter the gage holes. There are a number of gages which meet this condition: we have found the Olsen-DeShazer gage to be quite satisfactory in our work. This gage has points shaped as shown in Fig. 9 (c).

There are two types of holes that have been used in connection with "hand-held" strain gages—drilled holes and punched holes. Drilling is an expensive and time-consuming procedure especially in hard high carbon steel, since the drills used must be quite small. In spite of these difficulties some workers prefer this method and get satisfactory results. On the other hand, properly designed punches will rapidly produce accurately spaced holes of uniform and proper contour which, due to the cold working effect are actually smoother than drilled holes.

The technique of making satisfactory punched holes is not difficult but there are several important steps which will now be described in some detail. The tools used, with the exception of a good hammer, are shown in Fig. 10. A template (c) is convenient for locating the gage marks. This is held in the proper position on the wheel by one operator while a second man lightly punches through the holes in the template with the two pointed punch (a) making shallow punch marks in the wheel. If this is done lightly the points of the punch will remain sharp a longer time, especially on hard wheels. The second step is to deepen the shallow holes by restriking with the two pointed punch. Two or three blows may be necessary to produce a good hole about 1/8 in. in diameter as shown in Fig. 9 (a). In restriking, care should be taken to seat the punch well in the holes and hold it normal to the surface so that the holes will be deepened without producing ridges along the sides.

The points on the two pointed punch have an included angle of 90 deg. but in hard steel they soon become rounded so that the bottom of the holes become flat as shown in Fig. 9 (a). This would allow the points of the strain gage to touch on the bottom of the holes and give an indefinite reading.

A second punch, Fig. 10 (b), having a 60-deg. included angle is next used to "punch out" the bottoms of the holes made by the first punch. This is a single pointed punch and must be held normal to the surface and struck truly and straight to deepen the hole as shown in Fig. 9 (b). The diameter of this secondary punched hole, d_2, should be at least half of the diameter of the original hole, d_1. When this is properly done the point of the DeShazer gage will touch the sides of the secondary hole about halfway down as shown by the arrows in Fig. 9 (c).

The result of this procedure is to give a "ball and socket" effect to the gage points in the holes so that a slight variation in the angle between the plane of the gage and the plane of the rosette does not produce a noticeable variation in the gage reading.

The use of any "hand-held" strain gage involves considerable practice and the operator must acquire a sense of touch which enables him always to apply the same pressure in holding the gage. After repeatedly remeasuring a number of gage lines until consistent results are obtained, the operator can proceed with some confidence in the measurement of test rosettes.

An experienced operator will find that certain precautions aid materially in obtaining reliable readings and

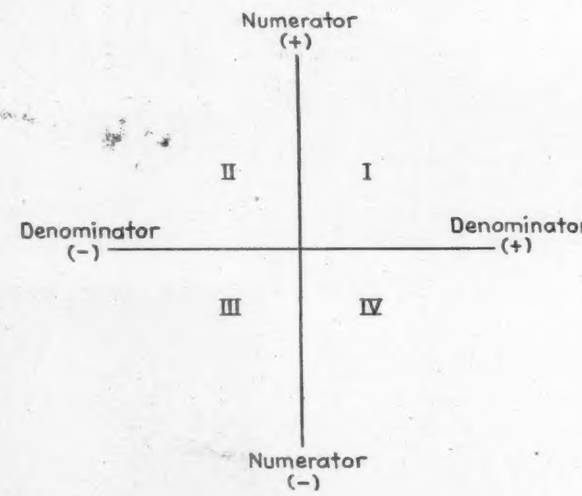


Fig. 7

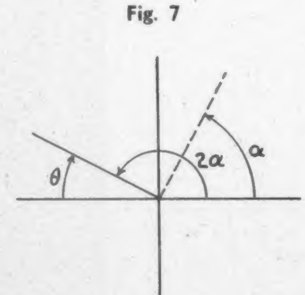


Fig. 13

the novice will do well to follow these from the start. In the first place the gage should never be turned end for end in measuring a gage line; the same point of the gage should always be placed in the same hole when making repeated measurements such as the initial and final readings. In the second place the gage should always be held in exactly the same manner, some prefer to place the forefingers on top of the gage but we get better results by applying the pressure with the thumbs as shown in Fig. 11.

One gage point is placed in one of the holes and the gage moved so that the other point is forcibly made to enter the other hole. The spring in the gage which pulls back on the movable point should be strong enough to

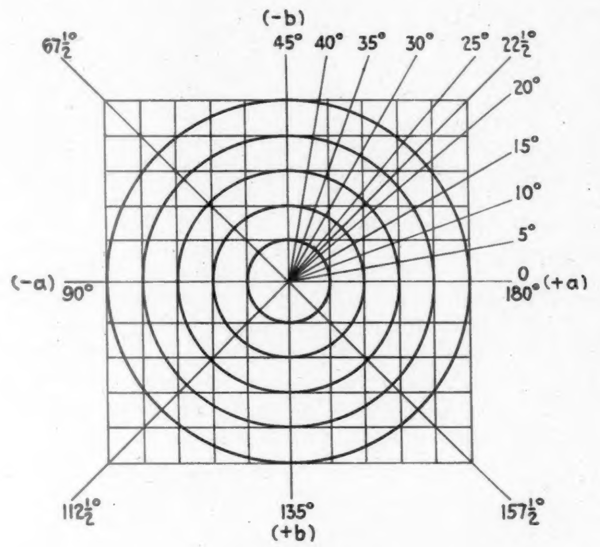


Fig. 14

furnish considerable opposition to this so the operator will have to apply force to "snap" it into the hole.

This will seat it well and lead to more consistent readings. The first gage point is kept in its hole and this action repeated several times in seating the second point. Concurrently the gage is moved forward and backward 5 to 10 deg. from the vertical and when the same reading can be repeated several times this is taken as the value for this gage line. Any difficulty in repeating may be due to an improperly shaped hole and if this is discovered while the initial readings are being taken the hole can be repunched. It will generally be found necessary only to use the second 60 deg. punch for this.

Although either the stationary or the movable point of the gage can be entered into the first hole a uniform practice must be adopted and all readings taken the same way. If the stationary point is entered first, the movable point is adjusted with the fingers.

In order to eliminate the effect of temperature on the gage readings, the wheels must be at a uniform temperature throughout and the final measurements should be made with the wheel or the rosettes at the same temperature as when the initial readings were taken. This is necessary because tests have shown that a temperature coefficient of expansion cannot be used to correct for temperature differences.

The temperature of the wheel is measured as shown in Fig. 12. A small ring of plasticine is pressed onto a horizontal surface and nearly filled with mercury. This soon assumes the temperature of the wheel by conduction and its temperature can then be measured with an ordinary thermometer. Subsequent measurements of the wheel or the rosettes after removal from the wheel must then be made at as nearly this initial temperature as possible.

After the initial measurements are made the rosettes will either be cut out and remeasured or else the wheel will be subjected to certain conditions of test or service and the rosettes again measured without being cut out. In either case it is essential that the gage holes be protected from damage. Not only must mechanical injury be prevented but the holes must be free from rust, grease or dirt when measured and the easiest way to accomplish this is to cover them with some protective layer.

When the wheel will not be heated much above room temperature or subject to other severe conditions we have found it sufficient to cover each hole with a ⅜-in. square of scotch masking tape and then coat over the entire area of the rosette with a generous application of rubber cement.

When gage marks are placed on wheels in regular railroad service some protection is needed which will

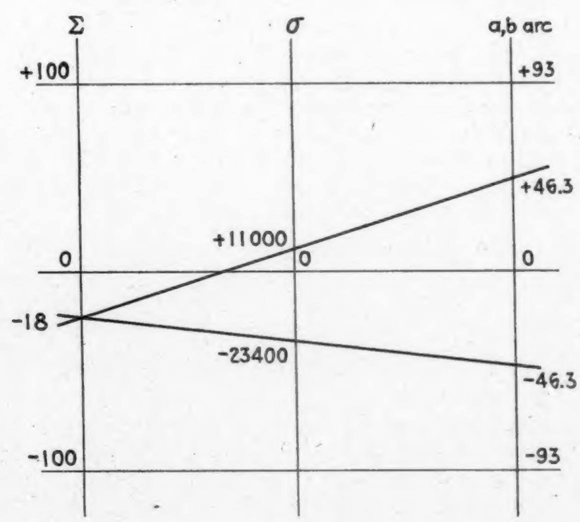


Fig. 15

withstand considerable heating from brake action and will withstand atmospheric conditions. Ordinary shellac has been fairly satisfactory when applied heavily directly to the holes. The only difficulty with this is its removal when the holes are to be remeasured. Weathering makes the shellac brittle and it can be removed by carefully scraping holes with small reamers made from broken machine taps followed by wiping with a close-woven

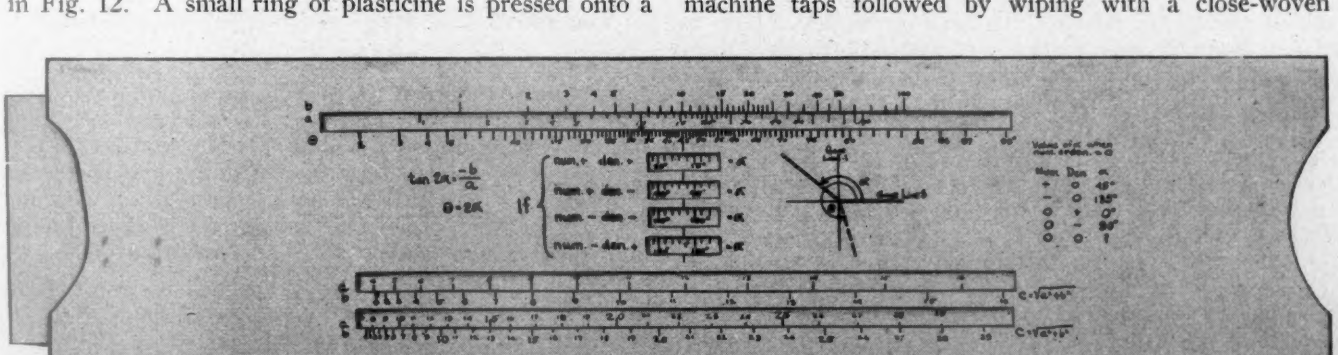


Fig. 16—Front of cardboard type slide rule for calculating rosettes

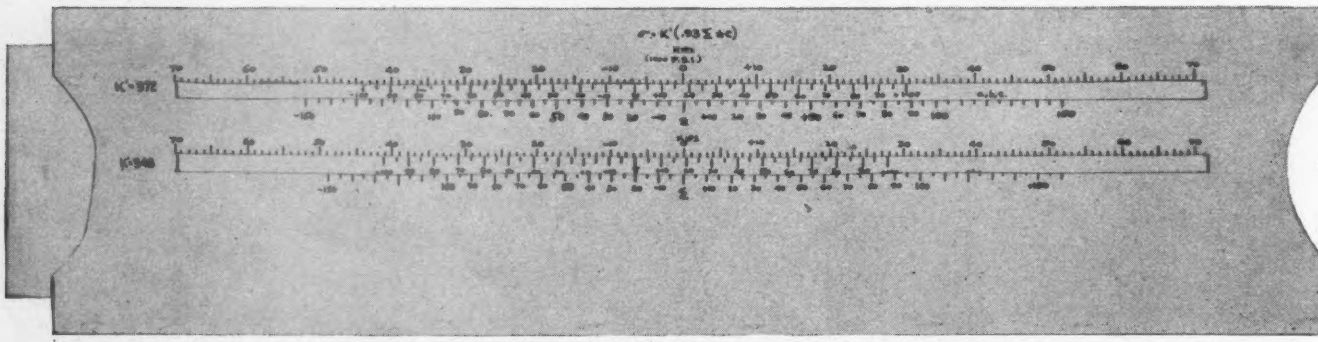


Fig. 17—Back of a cardboard type slide rule for calculating rosettes

thin cloth. A gasket sealing material called Permatex No. 1 has been tried recently and indications are that it will withstand atmospheric conditions and the heat effects of the brake action in service.

When the initial stresses are to be determined it is necessary to cut the rosettes from the wheel. The manner of cutting is unimportant provided it does not, in itself, produce any deformation of the rosette, or damage the gage holes. In the case of the plate, the rosettes are immediately opposite on the two faces and when a 3-in. by 3-in. section containing them is removed by sawing, for example, the rosettes are, for all practical purposes, completely relieved from the restraining forces originally imposed by the surrounding metal. Experiments have shown that no further relief is afforded by removing more metal from around the rosette, as by turning the blocks down to 2¼-in. diameter discs leaving only ⅛-in. outside the gage marks. By making the cuts ¼-in. to ½-in. from the gage marks the rosettes on the two faces do not have to be located precisely opposite and this leeway makes for a more practical working condition.

In the case of the rosettes on the tread, the underlying metal was carefully machined away leaving a circumferential layer about 3/16-in. thick. This resulted in the determination of the stresses in the heat affected surface layer.

When the gage lines are remeasured it is possible to check the corrections of the readings by virtue of a peculiar relationship in the rosette. It was shown in equation (28) that the sum of the strains in any two mutually perpendicular directions must always equal the sum of the strains on any other two mutually perpendicular lines. If the differences between the initial and final readings for each gage line are jotted down as measured this check can be quickly applied and if the rosette does not "balance" it will generally be found that one or more holes are damaged or dirty. The sample computation in Table I illustrates the procedure.

Table I

Gage line No.	Dial Divisions				
	Initial	Final Gage Readings			
		1st trial	Diff.	2nd trial	Diff.
1	980	988	+8	988	+8
2	1173	1176	+3	1176	+3
3	1040	1031	−9	1031	−9
4	867	878	+11	863	−4

$d_1 + d_3 = d_2 + d_4$ If rosette balances

$d_1 + d_3 = +8-9 = -1$; $d_2 + d_4 = +3+11 = +14$ Rosette does not balance

$d_1 + d_3 = +8-9 = -1$; $d_2 + d_4 = +3-4 = -1$ Rosette balances

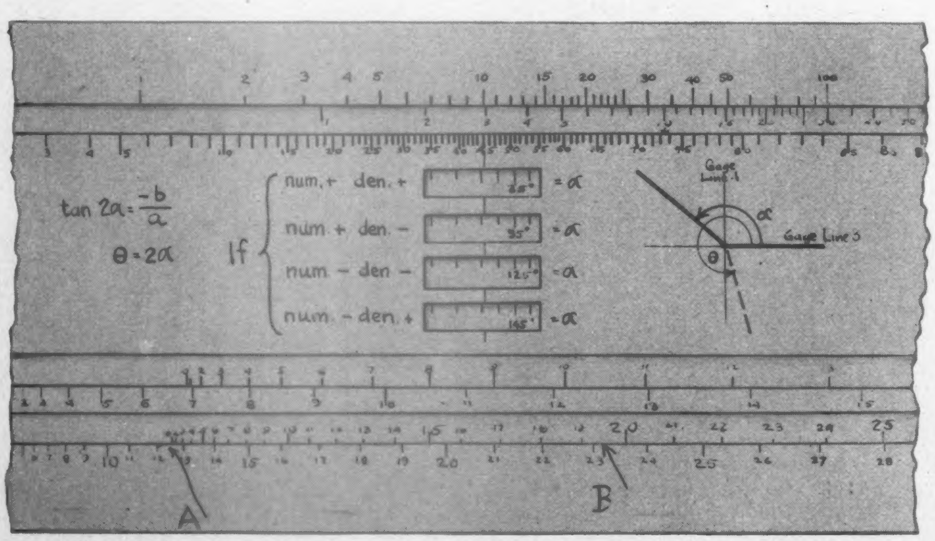


Fig. 18—Enlarged view of scales on slide rule showing setting for computing $c = \sqrt{a^2 + b^2}$

Calculation of Stresses from Strain Readings on the Rosette

In all cases there is an initial and a final set of gage readings on each rosette. The strain, along each gage line may be expressed, in dial divisions, by the difference between the initial and final reading but whether it represents a tension or a compression strain depends on whether or not the rosette was cut out before the final reading was made.

For example, if a certain gage line shortened, this would indicate an initial tension stress if the rosette had been relieved by cutting whereas it would indicate a compression stress if due to subsequent treatment between the initial and final measurements. The following simple rules will serve as a guide in determining the

sign of the strains and this can best be recorded at the time the differences are computed when the final readings are recorded.

1. When the wheel is intact and the rosette is not cut out.

The decrease of a gage length is due to compression and the difference should be marked (—).

The increase of a gage length is due to tension and the difference should be marked (+).

2. When the rosette is cut out.

The decrease of a gage length is due to the relief of tension and the difference should be marked (+).

The increase of a gage length is due to the relief of compression and the difference should be marked (—).

Note: The illustrative set of readings in Table I were for a rosette which was not cut out.

A typical set of data will be used for a rosette which was cut out before the final readings were made. Rule 2. therefore applies in determining the sign of the strains. The computations can be carried out in a straight-forward manner by direct substitution in equations (65) to (71) inclusive.

Gage line No.	Dial Reading in Divisions Initial	Final	Diff.
1	851	836	+15
2	960	952	+8
3	1050	1074	−24
4	985	1002	−17

The constant for the gage used in making the above measurements is given by the following equation.

$$e = Kd = 0.0000334d$$

where e is strain in inches per inch and d is a dial division on the strain gage. As already mentioned this constant K can be incorporated advantageously in equations (65) to (71).

$$11.15 \times 10^6 K = 11.15 \times 10^6 \times 0.0000334 = 372$$

For convenience this may be designated as K'.

Since there are several terms which are used in various combinations in equations (65) to (71) it will be convenient to calculate them first.

$$\Sigma = d_1+d_2+d_3+d_4 = 15 + 8 - 24 - 17 = -18$$
$$a = d_3 - d_1 = -24 - (+15) = -39$$
$$b = d_4 - d_2 = -17 - (+8) = -25$$
$$c = \sqrt{a^2 + b^2} = \sqrt{1521 + 625} = \pm 46.3$$

Equations (65) to (71) now become

$$\sigma_{max} = 372\ [0.93\Sigma + c] = 372\ [0.93 \times (-18) + 46.3] = +\ 11{,}000 \text{ lb. per. sq. in.}$$

$$\sigma_{min} = 372\ [0.93\Sigma - c] = 372\ [0.93 \times (-18) - 46.3] = -\ 23{,}400 \text{ lb. per sq. in.}$$

$$\sigma_1 = 372\ [0.93\Sigma - a] = 372\ [0.93 \times (-18) - (-39)] = +\ 8{,}300 \text{ lb. per sq. in.}$$

$$\sigma_2 = 372\ [0.93\Sigma - b] = 372\ [0.93 \times (-18) - (-25)] = +\ 3{,}100 \text{ lb. per sq. in.}$$

$$\sigma_3 = 372\ [0.93\Sigma + a] = 372\ [0.93 \times (-18) + (-39)] = -\ 20{,}700 \text{ lb. per. sq. in.}$$

$$\sigma_4 = 372\ [0.93\Sigma + b] = 372\ [0.93 \times (-18) + (-25)] = -\ 15{,}500 \text{ lb. per. sq. in.}$$

$$\sigma_\alpha = 372\ [0.93\Sigma + (-39 \cos 2\alpha) - (-25 \sin 2\alpha)\ ]$$

Any angle α can be substituted in this equation.

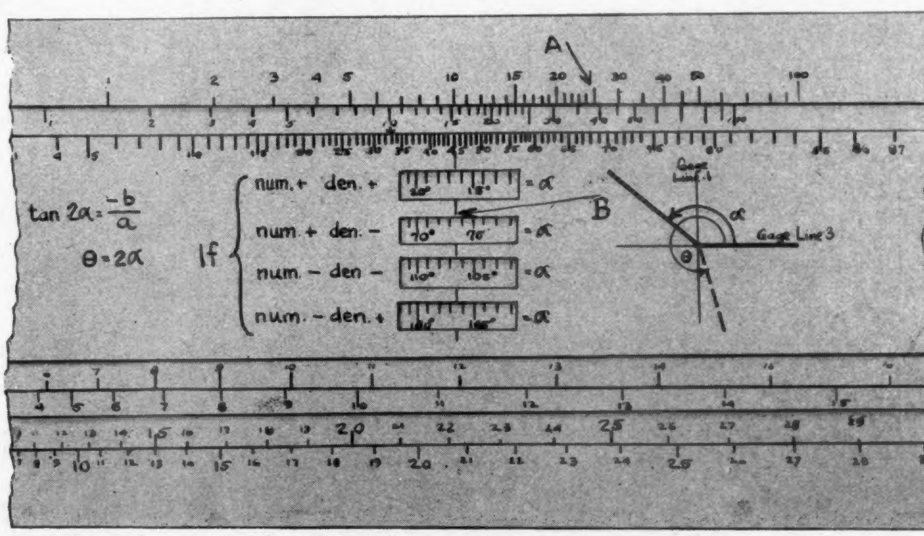


Fig. 19—Enlarged view of scales on slide rule showing setting for computing the angle α

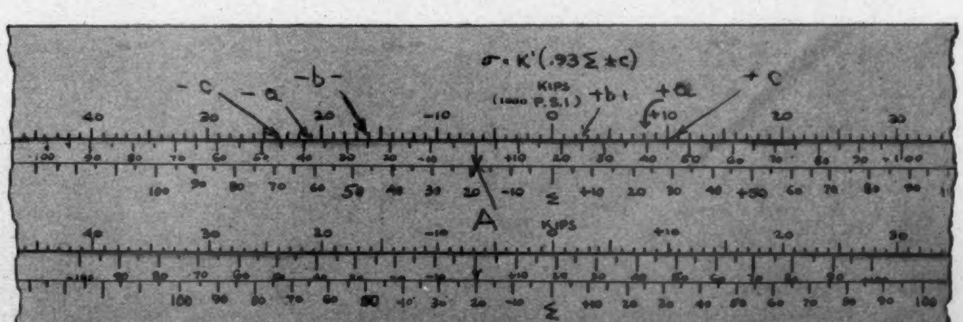


Fig. 20—Enlarged view of scales on slide rule showing setting for computing the maximum and minimum stresses and the stresses in the directions of the four gage lines

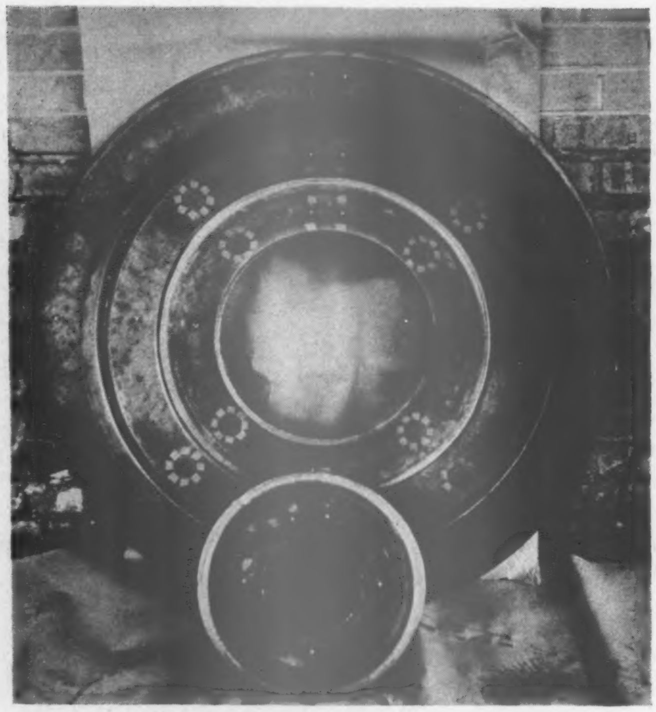


Fig. 21—Rings cut from a railroad car wheel to compare the rosette method with other methods for determining internal stresses

If $\alpha = 117$ deg. then $2\alpha = 234$ deg. which can be stated as 180 deg. + 54 deg.

Sin (180 deg. + 54 deg.) = –sin 54 deg. = –0.809

Cos (180 deg. + 54 deg.) = –cos 54 deg. = –0.588

$\sigma_{117 \text{ deg.}} = 372$ [0.93 (–18) + (–39) (–0.588) — (–25) (–0.809)] = –5,200 lb. per sq. in.

Since the maximum and minimum stresses are of opposite sign, $\sigma\gamma = \frac{1}{2} (\sigma_{max} - \sigma_{min}) = \frac{1}{2}$ [+ 11,000 — (–23,400)] = 17,200 lb. per sq. in.

It will be noted that all of the above stresses are given to the nearest 100 lb. per sq. in. This is one decimal place farther than their accuracy because of the limitations of the strain gage used in this case.

$$\text{Tan } 2\alpha = \frac{-b}{a} = \frac{-(-25)}{-39} = \frac{+25}{-39} = -0.641$$

It is seen from Fig. 7 which is repeated here, that 2α falls in the second quadrant. This must be determined by inspection of the signs of the numerator and the denominator because the usual trigonometric tables do not supply this information.

The angle obtained from the table of natural tangents for 0.641 is 32 deg. 40 min. This will be designated as θ and from trigonometry.

$$-\tan \theta = \tan (180° - \theta)$$

Since in the above equation

$$\tan 2\alpha = -0.641$$

$\tan^{-1}(-0.641)$ = (180 deg. –32 deg. 40 min.) = 147 deg. 20 min.

Then 2α = 147 deg. 20 min.

and α = 73 deg. 40 min.

The following rules will be helpful in determining 2α for any case that may arise.

Let θ = the angle taken from the table of tangents.

The relationship between the angles α, 2α and θ is shown in Fig. 13.

Then after the quadrant in which 2α falls is determined from Fig. 7 the value of 2α can be found from the following rules.

Quadrant found from Fig. 7	Value of 2α
I	θ
II	180 deg. – θ
III	180 deg. + θ
IV	360 deg. – θ

When a large number of computations are to be made the work is simplified if the steps are tabulated as completed. The sample form shown as Table II will be found convenient.

The use of such a tabular form greatly speeds up the work of computation and for many users will answer the purpose. Certain further aids to calculation have been developed, however. The radical $\sqrt{a^2 + b^2}$ and the angle of the maximum stress $\alpha = \frac{1}{2} \tan^{-1} (-b/a)$ can both be solved graphically from a right triangle whose sides are b and a and a polar chart similar to that shown in Fig. 14 has been constructed for these steps.

A series of concentric circles is used to determine the hypotenuse of the triangle which solves the radical. And the angles are evaluated so as to give α directly. The solution of steps (15) to (21) in the tabular form can be stated as a simple arithmetical operation as

$$K'(0.93X+Y)$$

which is equivalent to

$$0.93K'X+K'Y$$

Table II

Line No.	Rosette No.		1	2	3	4
	d_1 d_2		+15 +8	+10 +6	+40 +26	—8 +40
	d_3 d_4		—24 —17	—5 —1	+5 +19	—27 —75
1	$d_1+d_2+d_3+d_4$	Σ	—18			
2	d_3-d_1	a	—39			
3	d_4-d_2	b	—25			
4	$(d_3-d_1)^2$	a^2	1521			
5	$(d_4-d_2)^2$	b^2	625			
6	a^2+b^2	...	2146			
7	$\sqrt{a^2+b^2}$	c	±46.3			
8	0.93Σ	...	—16.7			
9	0.93Σ +c	...	+29.6			
10	0.93Σ—c	...	—63.0			
11	0.93Σ—a	...	—55.7			
12	0.93Σ—b	...	—41.7			
13	0.93Σ +a	...	+22.3			
14	0.93Σ +b	...	+ 8.3			
15	K′(0.93Σ +c)	σ_u	+11000			
16	K′(0.93Σ—c)	σ_v	—23400			
17	K′(0.93Σ—a)	σ_1	+8300			
18	K′(0.93Σ—b)	σ_2	+3100			
19	K′(0.93Σ +a)	σ_3	—20700			
20	K′(0.93Σ +b)	σ_4	—15500			
21	$\frac{1}{2}(\sigma_u - \sigma_v)$	γ	17200			
22	$\frac{1}{2}(\sigma_u)$ or $\frac{1}{2}(\sigma_v)$	$\sigma\gamma$	......			
23	—b/a	...	—0.641			
24	$\tan^{-1}$(—b/a)	θ	32 deg. 40 min.			
25	2α	...	147 deg. 20 min.			
26	α	...	73 deg. 40 min.			

By the use of proper scales in an alignment chart this series of steps can be easily solved. Such a chart is shown schematically in Fig. 15. The case is for the determination of σ_u and σ_v in the previous example.

Rules for constructing such an alignment chart are (1) Three vertical lines are drawn parallel and equidistant. (2) A horizontal zero line is drawn perpendicular to them and bisecting each. (3) Lay off a uniformly divided scale on the left hand scale with 120 divisions above and an equal number below the zero base line. (4) At $\Sigma = \pm 100$ draw horizontal lines parallel to the zero line. (5) The points where these lines intersect the right hand vertical lines have the value of $\pm$ 93 and the distance from 0 to these intersections should be divided into 93 equal parts to establish this scale. Extend to $\pm$ 100 divisions. (6) The scale for σ will depend on the gage constant K'. This is also a uniformly divided scale which can be established by computing from equation (65) the value σ_{max} for given values of Σ and c. A different chart will be required for each value of *K* or *K'*.

The compactness of the calculating devices shown in Figs. 14 and 15 can be improved by devising a special slide rule made of cardboard with a front and back slide and a slide working between them. The front of the rule, which is shown in Fig. 16, is about 5-in. wide and 20-in. long.

Table III—Stress in the Plate of a Wheel Obtained by The Rosette and Ring Methods, Kips* per sq. in.

Rosette No.	Stress: Rad.	Stress: Tan.	Stress: Max.	Ring Method Tangential
Front Face at Rim (Outer Ring)		....	....	+ 66
Rosette 1	−.8	− 12	− 12	
3	− 7	− 12	− 12	
5	− 6	− 11	− 11	
7	− 7	− 13	− 13	
Back Face at rim				
Rosette 1	+ 9	− 1	+ 10	
3	+ 10	0	+ 10	
5	+ 9	− 1	+ 9	
7	+ 12	− 1	+ 12	
Front Face at Hub (Inner Ring)		....	....	− 55
Rosette 2	+ 14	− 10	+ 14	
4	+ 16	− 11	+ 16	
6	+ 12	− 7	+ 12	
8	+ 9	− 3	+ 10	
Back face at Hub				
Rosette 2	− 2	− 15	− 15	
4	− 4	− 13	− 18	
6	− 9	− 8	− 10	
8	− 10	− 10	− 12	

* 1 Kip = 1,000 lb.

The two top scales are for setting values of a and b for determining the angle of the maximum stress, α. There are four scales (shown through windows) in the center of the rule and the proper one is chosen according to the signs of the numerator and denominator of the fractions –b/a.

There are two sets of scales at the bottom for calculating the equation $C = \sqrt{a^2 + b^2}$. The upper of these two sets of scales is designed for handling smaller numbers (up to C = 16) while the lower set will take up to C = 29. If larger numbers are involved submultiples can be used such as one half, one third or any other number that divides easily so that the conversion can be made mentally.

The back side of the rule is shown in Fig. 17. Two sets of scales are shown, each for a different value of *K'*. This side of the rule performs calculations of stress from the preliminary calculations of Σ, a, b and c. A different set of scales is required for each value of *K'*.

The use of the rule for calculating the stresses in the rosette given by way of example in Table II will now be described. The values of Σ, a and b are computed mentally and entered in the form.

Line No.	Rosette No.	1
	d_1 d_2 / d_3 d_4	+15 + 8 / —24 —17
1	Σ	—18
2	$(d_3—d_1) = a$	—39
3	$(d_4—d_2) = b$	—25
4	$\sqrt{a^2+b^2} = c$	±46.3
5	$K'\ (.93\Sigma+a) = \sigma_3$	—20700
6	$K'\ (.93\Sigma—a) = \sigma_1$	+8300
7	$K'\ (.93\Sigma+c) = \sigma_u$	+11000
8	$K'\ (.93\Sigma—c) = \sigma_v$	—23400
9	$\frac{1}{2}(\sigma_u—\sigma_v) = \sigma_y$ $\frac{1}{2}\sigma_u$ or $\frac{1}{2}\sigma_v = \sigma_y$	17200
	—b/a	
10	$\tan^{-1}(—b/a) = \theta$	
11	2α	73°40'
	α from d_3	

The value for $c = \sqrt{a^2 + b^2}$ is computed with the rule as shown in Fig. 18. Since b is larger than the scales will accommodate half values are used and the answer doubled. At the arrow marked *A* in Fig. 18 the zero point on the slide is set to 12.5 (one-half of b) and opposite the arrow marked *B* at 19.5 (one-half of a) on the slide, we read about 23.15 on the lower scale. Doubling this we get ±46.3 for c and enter this in the proper place in the form.

Before turning the rule over for computing the stresses we may now calculate the angle α which the maximum stress makes with gage line *3* (with the tangential direction). This setting of the rule is shown in Fig. 19. At the arrow marked *A* the value of b = —25 is shown opposite a = —39 on the adjacent scale. The proper one of the four scales for reading the answer α is selected by noting that both a and b are negative and therefore the numerator of the fraction –b/a is positive and denominator is negative. The answer is found on the scale marked accordingly and the arrow marked *B* indicates the value for α as 73-⅔ deg. or 73 deg. 40 min. This can be entered directly in the tabulation without reference to the intermediate items –b/a, $\tan^{-1}(-b/a) = \theta$, and 2α which are necessary when trigonometric tables are used.

The stress calculations are made on the reverse side of the rule as shown in Fig. 20. The constant for the De Shazer gage used in making these particular readings was such that *K'* = 372 so the upper set of scales is used. The arrow on the slide is set at Σ = —18 as indicated at the large arrow marked *A* then opposite values of ± a, ±b, and ± c on the scale on the slide all of the stresses shown in Table II can be read from the top scale of the rule. The actual signs of the numerical values of a and b must be considered. In this case both are negative so that σ_3 which is computed from +a would in this case be read at a = —39 on the rule (arrow marked = a) and σ_1 is read at a = +39 on the rule (arrow marked +a).

The maximum and minimum stresses are found by using ±c as indicated by the arrows marked +c and —c. Ordinarily the stresses at gage lines 2 and 4 are of little interest and are not computed but if desired they are obtained by using +b and —b as described for +a and —a. The shear stress is determined in the same way as before from the maximum and minimum stresses taking proper consideration of their signs.

Conclusion

From the foregoing presentation it will be understood that the rosette method is applicable to a wide variety

of studies on various types of structures. We are concerned here only with its application to wheels but even in this field there is a wide range of effects that can be studied by its use. The authors first used it to study stresses in wheels under static load and later (in 1936) applied it to an investigation of the effect of brake action on plate stresses as determined by extensive tests over a two and a half year period on the A. A. R. brake testing machine at Purdue University, and since then for over three years on a special wheel testing machine at the Butler, Pennsylvania Plant of the American Rolling Mill Company. This was followed with measurements of the changes in stress in wheels in service. In addition to these studies, tests have been made to study the influence of manufacturing variables on stresses in wrought steel railroad wheels. Thus the methods herein described have proved useful in the study of railroad service conditions and the production of wrought steel wheels that would best meet them.

Acknowledgments

The authors are indebted to R. L. Templin, of the Research Laboratory of the Aluminum Company of America, for first calling to their attention the possibility of using the rosette method for determining internal stresses in railroad car wheels. They also appreciate the helpful comments that he and R. G. Sturm, of the same laboratory, have made in reviewing the manuscript for this article.

H. L. Whittmore and W. R. Osgood, of the National Bureau of Standards, also read the manuscripts and offered helpful suggestions.

Robert H. Heyer and Robert P. Hindman, of The American Rolling Mill Company, also rendered valuable assistance, the former in preparing special charts for graphical computation, and the latter in conducting the comparative study of the rosette and ring methods described in the Appendix.

The authors also wish to express their appreciation to Anson Hayes, Director, Research Laboratories of The American Rolling Mill Company, for his constructive suggestions in connection with this study.

Appendix I

Comparison of Rosette Method With Ring Method Of Determining Internal Stresses in a Railroad Car Wheel*

The ring method for determining internal stresses in a railroad car wheel has been used to some extent. This method, illustrated in Fig. 21 consists of cutting the plate into two rings. The width of one ring extends from the rim fillet to the middle of the plate and the width of the other ring is from the middle of the plate to the hub fillet. Two pins or other reference points are first put at the mid-width of each ring, two inches part in a tangential direction. The distances between these pins are measured with micrometers or some other suitable measuring instrument. The rings are then cut off of the wheel and slotted radially between the pins. The tangential distances between the reference points are measured again. Using the mean circumference of the ring (diminished by the distance between the reference points) as the gage length, the tangential strain in inches per inch is computed. The product of the strain and the modulus of elasticity gives the tangential stress in pounds per square inch.

Table IV—Calibration Chart of Federal Dial

.005 = + .0001	.105 = + .00011
.010 = + .00009	.110 = + .00012
.015 = + .00011	.115 = + .00009
.020 = + .00006	.120 = + .00001
.025 = + .00006	.125 = - .00001
.030 = + .00005	.130 = + .00001
.035 = + .00003	.135 = + .00009
.040 = - .00011	.140 = + .0001
.045 = - .00011	.145 = + .00008
.050 = - .00001	.150 = + .00002
.055 = + .00008	.155 = + .00007
.060 = + .0001	.160 = + .00008
.065 = + .00011	.165 = + .00009
.070 = + .00002	.170 = + .00001
.075 = - .00004	.175 = - .00008
.080 = - .00005	.180 = - .00001
.085 = - .00001	.185 = + .00004
.090 = - .00005	.190 = - .00003
.095 = - .00009	.195 = - .00018
.100 = + .00002	.200 = + .00002

* Taken from Report W-78, May 23, 1938, by R. P. Hindman, Butler Metallurgical Department, American Rolling Mill Company.

In order to check the ring method against the rosette method, a control cooled wheel was used and four rosettes were placed on the front and back face of each ring before the rings were cut out. The rings were cut and measured in the normal manner and the tangential stress calculated. Finally the rosettes were cut out of the rings and their stresses were calculated. A comparison of the results obtained from each method is shown in Table III.

Table V—Calibration Chart of Olsen DeShazer Strain Gauge — 2 in. Gauge Length

Standard Calibrating Apparatus	Instrument Reading Upward	Instrument Reading Downward	Standard Calibrating Apparatus	Instrument Reading Upward	Instrument Reading Downward
.0000"	1000	1000	.0210"	1315.2	686
.0010	1015	985	.0220	1330	670.7
.0020	1030	970	.0230	1345	656
.0030	1045	954.5	.0240	1360	639
.0040	1060	939.8	.0250	1375	624.4
.0050	1075	925	.0260	1395	610
.0060	1090	910	.0270	1405.5	595.5
.0070	1105	895	.0280	1420	580.3
.0080	1120	880	.0290	1435	566
.0090	1135.5	865	.0300	1450.5	549.3
.0100	1150.3	850	.0310	1465	535.3
.0110	1165	835	.0320	1480	520.6
.0120	1180	820	.0330	1495.8	505
.0130	1195	805	.0340	1510.6	490.7
.0140	1210.5	790.5	.0350	1525.5	474.9
.0150	1226	775.6	.0360	1540.8	460.9
.0160	1240	760	.0370	1556.1	445.9
.0170	1256	745	.0380	1572.1	430.1
.0180	1270	730.9	.0390	1587.3	415
.0190	1285	715	.0400	1601.7	399.6
.0200	1300	700.5			

The ring next to the rim showed a tangential stress of +66,000 lb. per sq. in. which is too high for this type of wheel. The rosettes cut from this ring showed that the tangential stress on the front face average —12,000 lb. per sq. in. and on the back face about —1,000 lb. per sq. in. The radial stress is not given by the ring method but the rosettes showed an average of —7,000 lb. per sq. in. on the front face and +10,000 lb. per sq. in. on the back face. These two methods also show large differences in stress on the ring next to the hub. The ring method gives a tangential stress of —55,000 lb. per sq. in., while the rosette method gives an average tangential stress of —8,000 lb. per sq. in. on the front face and —12,000 lb. per sq. in. on the back face. The average radial stresses from the rosettes are +13,000 lb. per sq. in. on the front face and —6,000 lb. per sq. in. on the back face.

In considering the inconsistency between the two methods, it is observed that there is a variation in the stress distribution in the plate from hub to rim as shown by the radial stresses computed from the rosettes. The back face is in radial tension at the rim and compression at the hub and on the front face the opposite occurs. This could result in a bending moment that tends to open up or close up the rings when they are cut radially between the reference marks. It is thought that this accounts for the abnormally large dimension changes across the radial cuts.

(*Continued on page 19*)

George McCormick, D. Eng.

The G. S. M. P. of the Southern Pacific Company who was highly honored by his alma mater

GEORGE McCORMICK, chief of the mechanical department of a great western railway system, the Southern Pacific Company, last June was given the degree of Doctor of Engineering (D. Eng.) by his Alma Mater, the Agricultural and Mechanical College of Texas. By what route did he arrive at so exalted a position? What training, what traits of character, what accomplishments fitted him for so important an assignment on the railway, or inspired Texas Agricultural and Mechanical College to honor him so highly?

A Son of Texas

Before attempting to answer these questions it may be well to review the high spots in Mr. McCormick's career. He is a native of and the greater part of his life was spent in the Lone Star State, Texas, with its great open spaces, its colorful background and history, and its vast natural resources. His father, George McCormick, Sr., served at one time as an attorney general of that state. Born in Columbus, Texas, July 15, 1872, when the Far West was still in a pioneer stage of development, he grew up in an atmosphere which presented a definite challenge to the ambitious young man of that day.

Three railroad mechanical department officers were given honorary doctors' degrees by colleges and universities last June. This is a most unusual occurrence; in fact, is quite extraordinary. Why were these three men, independently and in quite different parts of the nation, so highly honored by three different educational institutions? This is the first one of three articles to answer this question. A similar story on Frederick W. Hankins, assistant vice-president of the Pennsylvania Railroad, will appear in our February issue; and one on K. F. Nystrom, mechanical assistant to the chief operating officer of the Chicago, Milwaukee, St. Paul & Pacific, will be featured in our March issue.

Texas A. & M., when he attended it, was a small institution with only about 200 students. He was graduated with the degree of Bachelor of Mechanical Engineering in 1891 at the age of 19, a clear indication of the burning of much midnight oil. In spite of that, however, he could not be classed as a "dig." The college then, as now, was very much of a military school. Mr. McCormick was a cadet captain in his senior year and was one of three graduates recommended to the United States Government for an Army Commission. One of his prized possessions is a medal won at college as the best drilled man of the crack Company of Ross Volunteers. This military training during his college years did much to shape his early career.

Starts as Shop Apprentice

After graduation he became a machinist apprentice in the shops of the Galveston, Harrisburg & San Antonio (now Southern Pacific) at Houston, Texas, and in the latter part of 1893 was made a draftsman in the office of the superintendent motive power at that place. A few months later, early in 1894, he was transferred to San Antonio, Texas, on a special assignment to supervise the redesigning of a number of locomotives. While at San Antonio he joined the Belknap Rifles, a crack State Militia Company, later serving as its captain. He was recalled to Houston in 1895 and was appointed chief draftsman. Military drill seems to have lost none of its fascination for him and he soon joined the historic and famous Houston Light Guard, which had been organized in 1873.

Captain in Spanish-American War

When the Spanish-American War broke out in 1898 the Adjutant General of the state was commissioned to raise a Texas regiment. It was composed of the twelve best military companies of the state and the Houston Light Guard was designated Company A, First Texas Volunteer Infantry. Mr. McCormick was elected captain and the company was mustered into service at Austin, Texas, May 10, 1898. It was encamped successively at Mobile, Miami and Jacksonville, and was about to embark for Cuba at Savannah, Ga., when the war ended. Captain McCormick's company passed through the typhoid epidemic at Mobile without the loss of a man.

Promptly at the close of the war Captain McCormick resigned to return to railroad work, although his company did go on to Cuba as part of the Army of Occupation. It returned after a few months and was mustered out April 18, 1899. It continued, however, as the Houston Light Guard and Mr. McCormick was again elected its captain, serving in that capacity for some time. The Light Guard, under his leadership, gave an excellent account of itself at the time of the tidal wave, which brought death and destruction to Galveston in 1900; it was an important factor in the preservation of order and in assisting in the rehabilitation of the city.

Mr. McCormick had resumed his position as chief draftsman of the Gulf, Harrisburg & San Antonio when he returned to railroad service, but shortly thereafter, in 1900, was appointed mechanical engineer, in which capacity he remained until December, 1911, when he was made assistant superintendent of the El Paso Division, with headquarters at El Paso. This was in the period when the "unit system of organization" was being applied on the Harriman Lines, under the direction of Julius Krutt-

George McCormick

schnitt. Mr. McCormick was primarily concerned with mechanical department affairs on the division, but was also, under certain conditions at least, charged with much broader responsibilities than when operating under a more highly specialized title.*

In February, 1913, he was made assistant general manager (mechanical) for all of the Southern Pacific Texas Lines, with headquarters at Houston, Texas. In December, 1916, he was appointed general superintendent motive power of the Southern Pacific Company, Pacific System, with headquarters at San Francisco, Cal.

Effect of Military Training

There are a few places in this rather sketchy outline of Mr. McCormick's career that require amplifying. While, judging from his college experiences, he was endowed by nature for military leadership, his training and experience in that field doubtless did much to improve his administrative ability. One of his associates, in fact, suggests that "probably Mr. McCormick's early military training is largely responsible for his ability in properly receiving and giving orders and his ability to handle a great deal of work, always keeping his own desk cleared, and reserving to himself ample time for reflection and thought on various problems at hand of the day and of the future. He is always calm and composed even during trying times and he always seems to feel, no matter how difficult the problem at hand, it can be satisfactorily solved, and after a brief discussion he has the ability to pick out the proper party to assign the task for final disposition and report."

It is noteworthy, also, that his military preferment was not due to the appointive power of higher ups, but rather, after his college experience, to election by his associates. It was thus an expression of the general recognition of his leadership qualities, as compared to selection on a more limited or autocratic basis. As a matter of fact, quiet spoken and thoughtful, he is the antithesis of the "top sergeant" type of drill master so frequently pictured in military service.

The extended period over which he headed up the department of mechanical engineering and design at Houston gave him an unusual opportunity to become a factor in community life; at least, as compared to many mechanical officers who, of necessity, are more frequently moved from place to place.

A "Modern Pioneer"

His long experience in the field of design doubtless accounts, in part at least, for his numerous inventions—so numerous and so important that he was honored as one of the "Modern Pioneers" by the National Association of Manufacturers in 1940. Among his inventions are a system of oil lubrication for driving boxes and other locomotive bearings, retaining clips to prevent loose tires from slipping off wheel centers, locomotive boiler drop plug and multiple system of its application, truck pedestal safety tie bar, and improved lubrication of locomotive connecting rod and crank pin bearings.

Under Mr. McCormick's leadership of a quarter of a century as head of the mechanical department of the Southern Pacific, extensive improvements have been made in shop facilities, passenger and freight cars and motive power, both as to capacity and efficiency. This is particularly notable in the field of motive power. In 1916 the heaviest passenger locomotive was of the 4-6-2 type; a boiler pressure of 200 lb. was used, developing a tractive effort of 29,900 lb., with a boiler efficiency of about 67½ per cent. In 1941 the 4-8-4 type was placed in service, with a boiler pressure of 300 lb., developing a maximum tractive effort of 79,670 lb., and with an over-all boiler efficiency of 90 per cent. These new locomotives handle 1,000-ton passenger trains on a one per cent grade at speeds of 53 miles an hour. The increase in capacity, measured by gross ton-miles per train-hour is about 200 per cent.

In 1916 the 2-8-8-2 Mallet was used in freight service and had a boiler pressure of 200 lb.; it developed a tractive effort of 94,880 lb., with a boiler efficiency of about 78 per cent. In 1940 the present 4-8-8-2 type articulated locomotives were placed in service, using 250 lb. boiler pressure and developing a tractive force of 124,300 lb., with an over-all boiler efficiency of 92 per cent. The increase in the capacity of these locomotives, measured in gross ton-miles produced per train-hour, is about 125 per cent.

It is significant that notwithstanding the great increase in the size of locomotives, the average cost of repairs per train-mile run has remained about the same in freight service, and in passenger service has actually been reduced. The average cost of fuel per thousand gross ton-miles in freight service has also been reduced about 44½ per cent, notwithstanding the higher speeds which are now maintained.

It is not to be wondered at that Mr. McCormick was elected a member of the General Committee of the Mechanical Division, Association of American Railroads, in 1939, or that he has served on such committees of that division as locomotive design and construction; design and construction of tank cars; design, maintenance and operation of electric rolling stock; and automatic train control signals.

Leadership Qualities

This story is based largely on expressions from intimate associates of Mr. McCormick who have known him for a long time; each one was asked to express what he thought to be his outstanding characteristics or accomplishments. It is generally recognized that an important attribute of a leader is the ability to teach others. It is significant that early in his career, when he was stationed in San Antonio in 1892, he served as an instructor in the apprentice school. A mechanical department officer, now holding a high position, was one of the apprentices at that time and states that even then he "became impressed with his just and considerate administration of whatever duties might be committed to his care."

When he assumed the leadership of the mechanical department of the Southern Pacific he "came to us practically a stranger," says one of his associates, and "with the exception of Mrs. McCormick, he came alone." Apparently he was not long in adjusting himself to the new surroundings and "his honesty and fairness made us admire and respect him, not only as a man, but as a very outstanding leader."

Another of his associates points out that his "most important personal characteristic is the ability to understand human nature and secure co-operative results from assistants and subordinates." In this connection reference is made to "his kindly but firm disposition," and again, "he mixes his work, even his most important work, with good humor and good cheer."

All of his associates recognize his mechanical ability and initiative and his thorough knowledge of mechanical department problems. We hear him characterized as one who "wisely and swiftly makes plans and courageously executes them, because he is a master of his work." Another expresses it in this way, "Genuine knowledge

* See paper by Major Charles Hine on "The Unit System of Organization" in the Western Railway Club Proceedings for January 21, 1910; American Engineer and Railroad Journal, March 1910, page 106; and Railway Age Gazette, January 18, 1910, page 134.

has always been one of the cornerstones of his real leadership."

That it has been his practice to know what is going on out on the line and in the shops is indicated by the following story.

"In Conference"

One day, while a Southern Pacific train was standing at a station, a passenger, pacing up and down the platform for exercise, observed some distance away two men seated on a pile of crossties. One of them, apparently a laborer, dressed in dirty overalls, his face smudged and soiled, was talking with much emphasis and many gesticulations of his grimy hands.

The other man, in the garb of an office worker, sat quietly by, listening with thoughtful concentration to what the speaker was saying; from time to time nodding in silent agreement, now interjecting a short comment, and again shaking his head in negation, but all the while keeping his keen eyes intently fastened on the speaker.

"Who is that man?" asked the passenger of the conductor.

"I don't know. Some foreman or car whacker, I guess," was the reply.

"No, no; I mean the other man."

"Oh, that's George McCormick, the general superintendent of motive power," said the conductor. "He's probably 'in conference,' " he added, with a chuckle.

And very likely he was right. It is said that George McCormick has held a great many more informal conferences out on the line with the men who do the work than he ever thought of holding in the seclusion of his office.

Capt. George McCormick
(Jacksonville, Fla., September, 1898)

Mr. McCormick has a keen sense of good organization procedure and the importance of preserving lines of authority. It is said that when making inspection trips through the shops he sometimes finds a workman doing the job in the wrong way. He may ask questions, but will never criticize the man. He knows that the supervision is responsible and that the proper procedure is to take the matter up with the worker's superiors to insure that he is properly supervised in the future.

He is said to possess the happy trait of standing a hundred per cent back of his men if he thinks they are trying to do the right thing, even though they may make mistakes, but he has no use for anyone who tries to shirk responsibility.

Can Be Tough on Occasion

His good nature does not encourage carelessness or laxity on the part of those with whom he deals, because it is balanced by determination and firmness. One of his associates emphasized these traits in the following way: "We like him because he's a gentleman and gives everybody else credit for being one. He can be plenty tough if he thinks the occasion calls for it—but he always makes his peace before the day is over. He may do this indirectly and without reference to the 'call-down,' but he lets you know very clearly that it is all well again between you and the old man, and you don't have to go home to worry about the job."

Exemplifies the Golden Rule

"His great rule of action," comments another associate, "is the Golden Rule. He leads men by the heart strings, and does not drive them. Men gladly follow him for he is unselfish and constantly has in mind their welfare and advancement, because he understands and sympathizes with the problems of the everyday man, all of which produces results and wins loyalty."

So far as we can find, Mr. McCormick has no particular hobbies. He has never lost his interest in the Houston Light Guard and is now an honorary vice-president of the Houston Light Guard Veterans Association, which was organized in 1910. The chapter of the Spanish War Veterans in Houston has been named after him. He is a charter and life member of Arabia Temple of the Shrine; a member of Scottish Rite, El Paso Consistory No. 3; a member of Knights Templar, Ruthven Commandery No. 2 of Houston, and of Gray Lodge, No. 329, A. F. & A. M., Houston. He is also a member of the Bohemian Club of San Francisco; its annual outing, known as the "Jinks," is held in the famous Bohemian Grove near San Francisco, and is widely known because of the attendance of men of national and international prominence.

In Conclusion

The men who today are climbing the ladder to greater influence and success on our railroads and in industry do not, of course, have the same backgrounds as those who got their start in the last half of the nineteenth century. Conditions in transportation and industry are radically different from those which confronted the preceding generation, and yet men like Mr. McCormick were successful in adapting themselves to the radical changes that took place over the years. To do so they had to keep their eyes and ears and minds open. They could not afford to get into a rut, or to drift along with the tide. It was a constant struggle all along the line. Likewise, the younger men of today must be keenly alert to changing conditions and new problems, which in these days are arising almost kaleidoscopically.

Fundamentally, the basic principles of good leadership do not change, although it is true that science and research are continually throwing more and more light on better methods and practices in dealing with the human element in an organization. A few rare souls seem to sense the secrets of good management. Even they can improve their ability, however, by keeping in touch with the progress which is steadily being made in our understanding of the art of personnel management and industrial leadership.

The Mechanical Engineer and Defense Transportation

(*Continued from page 5*)

a railroad had stopped applying new fireboxes and adopted the practice of patching until, after a time, many of the fireboxes on that road had become but a mass of patches. While recognizing the necessity of patching good fireboxes, particularly near the mud ring, Mr. Hall said that the result of his investigation of that particular road developed that more steel had been used in patching fireboxes than had previously been used in applying new ones.

P. W. Kiefer, chief engineer of motive power and, rolling stock, New York Central, reviewed the work of the A. A. R. in standardizing car design and K. H. Nystrom, mechanical assistant to chief operating officer, Chicago, Milwaukee, St. Paul & Pacific, made the suggestion that the use of welding could and should be extended during this emergency to speed up many of our maintenance and reclamation operations. Mr. Nystrom also ventured the suggestion that by careful planning a railroad could keep bad orders below 1.5 per cent. He said, "We can utilize freight cars to a still greater extent than we have up to the present time and obtain more miles per car per day with less cars unservicable. Mr. Nystrom also said he believed that the unservicable locomotives could be reduced to approximately half of the present 16 per cent. In commenting on this he recognized the present large percentage of unservicable locomotives as being of the older type. The question of materials and the ability to get them entered almost all discussions and the priorities system came in for its share of comment. One speaker said that reclamation should play a larger part in the immediate future and material which fails to meet specifications should not be rejected if it could be reclaimed. The attitude which railroad men might well take toward the priority system was rather well summed up by C. E. Smith, vice-president of the New Haven Road when he said, "we must get materials and we are going to get them, not solely by the harsh application of priority ratings because that cannot be done. We have got to get them by 'give-and-take'. You have heard that the priority system will be supplemented by an allocation system in cases where priorities would give all available materials to defense industries and this would deny the same material to other industries vital to defense that need them just as badly. Insofar as the railroads are concerned that job of give-and-take has been pretty well done to date."

C. C. Bailey, General Electric Company, summarized the job that all railroads will have to do from now on when he said, "in order to keep on keeping trains moving without delay maintenance and inspection should be even more exacting. Catching up with defects before they happen will make things last longer with fewer headaches. Concluding his remarks, along this line, Mr. Bailey said that turning an engine in two or three hours may build up a fine looking statistical record but if the road delays on the other side of the ledger indicate that the inspector overlooked serious defects, it is not very good railroading.

D. S. Ellis, chief mechanical officer, C. & O., said that in making use of substitute materials it should be borne in mind that no changes be required in the basic design if possible.

In commenting on the question of standardizing locomotives H. H. Urbach, mechanical assistant to executive vice-president, C. B. & Q., said that he would rather think in terms of standard locomotive parts rather than of entire locomotives. He questioned the advisability of developing standard locomotive designs.

Andrew Stevenson, chief of the Agricultural, Automotive, and Railroad Section of the Division of Civilian Supplies, O. P. M., suggested that in selecting substitute materials care be taken to insure that the substitutes themselves are not soon to become scarce. He commented particularly on the large requirements for copper in the manufacture of brass shell casings and suggested that anything the railroads could do to reduce the amount of brass required in journal bearings, or, alternatively, to help find some satisfactory substitute for brass in shell casings would be generally helpful.

John Dixon, president, Lima Locomotive Works, said that during the last war ten months were lost in the development of standard designs by the United States Railroad Administration, and expressed his approval of the A. A. R. proposal to limit locomotive orders to existing designs. The builders, he believes, will be willing to exchange existing patterns, dies, and drawings.

Frederick E. Lyford, trustee, N. Y. O. & W., said that he did not believe that we had as yet done the best with what we have available, citing the great difference in the freedom from engine failures and hot boxes which frequently can be found on immediately adjoining railroads. Speaking of the possibilities of more intensive utilization of equipment, he called attention to an increase of 9 per cent in locomotive miles per day on the N. Y. O. & W. during 10 months of 1941 over the same period for 1940.

Lawrence Richardson, mechanical assistant to vice-president and general manager, B. & M., cited examples of how common sense and ingenuity in departing from standards of loading and track alignment had permitted the movement of marine boilers over a route of restricted clearances.

Stresses in Car Wheels

(*Continued from page 14*)

Furthermore, the rosette gives the stress at the point of its location and four such rosettes equally spaced around the ring should give an accurate measure of the average stress in that ring. However, none of the values determined from the rosettes even approach the tangential stress indicated by the ring method. Since the rosette method is unaffected by the bending stresses and other effects that interfere with the ring method the former is to be preferred. As a matter of fact the ring method gives misleading results.

Appendix II

Calibration of DeShazer Gages

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has always been one of the cornerstones of his real leadership."

That it has been his practice to know what is going on out on the line and in the shops is indicated by the following story.

"In Conference"

One day, while a Southern Pacific train was standing at a station, a passenger, pacing up and down the platform for exercise, observed some distance away two men seated on a pile of crossties. One of them, apparently a laborer, dressed in dirty overalls, his face smudged and soiled, was talking with much emphasis and many gesticulations of his grimy hands.

The other man, in the garb of an office worker, sat quietly by, listening with thoughtful concentration to what the speaker was saying; from time to time nodding in silent agreement, now interjecting a short comment, and again shaking his head in negation, but all the while keeping his keen eyes intently fastened on the speaker.

"Who is that man?" asked the passenger of the conductor.

"I don't know. Some foreman or car whacker, I guess," was the reply.

"No, no; I mean the other man."

"Oh, that's George McCormick, the general superintendent of motive power," said the conductor. "He's probably 'in conference,' " he added, with a chuckle.

And very likely he was right. It is said that George McCormick has held a great many more informal conferences out on the line with the men who do the work than he ever thought of holding in the seclusion of his office.

Capt. George McCormick
(Jacksonville, Fla., September, 1898)

Mr. McCormick has a keen sense of good organization procedure and the importance of preserving lines of authority. It is said that when making inspection trips through the shops he sometimes finds a workman doing the job in the wrong way. He may ask questions, but will never criticize the man. He knows that the supervision is responsible and that the proper procedure is to take the matter up with the worker's superiors to insure that he is properly supervised in the future.

He is said to possess the happy trait of standing a hundred per cent back of his men if he thinks they are trying to do the right thing, even though they may make mistakes, but he has no use for anyone who tries to shirk responsibility.

Can Be Tough on Occasion

His good nature does not encourage carelessness or laxity on the part of those with whom he deals, because it is balanced by determination and firmness. One of his associates emphasized these traits in the following way: "We like him because he's a gentleman and gives everybody else credit for being one. He can be plenty tough if he thinks the occasion calls for it—but he always makes his peace before the day is over. He may do this indirectly and without reference to the 'call-down,' but he lets you know very clearly that it is all well again between you and the old man, and you don't have to go home to worry about the job."

Exemplifies the Golden Rule

"His great rule of action," comments another associate, "is the Golden Rule. He leads men by the heart strings, and does not drive them. Men gladly follow him for he is unselfish and constantly has in mind their welfare and advancement, because he understands and sympathizes with the problems of the everyday man, all of which produces results and wins loyalty."

So far as we can find, Mr. McCormick has no particular hobbies. He has never lost his interest in the Houston Light Guard and is now an honorary vice-president of the Houston Light Guard Veterans Association, which was organized in 1910. The chapter of the Spanish War Veterans in Houston has been named after him. He is a charter and life member of Arabia Temple of the Shrine; a member of Scottish Rite, El Paso Consistory No. 3; a member of Knights Templar, Ruthven Commandery No. 2 of Houston, and of Gray Lodge, No. 329, A. F. & A. M., Houston. He is also a member of the Bohemian Club of San Francisco; its annual outing, known as the "Jinks," is held in the famous Bohemian Grove near San Francisco, and is widely known because of the attendance of men of national and international prominence.

In Conclusion

The men who today are climbing the ladder to greater influence and success on our railroads and in industry do not, of course, have the same backgrounds as those who got their start in the last half of the nineteenth century. Conditions in transportation and industry are radically different from those which confronted the preceding generation, and yet men like Mr. McCormick were successful in adapting themselves to the radical changes that took place over the years. To do so they had to keep their eyes and ears and minds open. They could not afford to get into a rut, or to drift along with the tide. It was a constant struggle all along the line. Likewise, the younger men of today must be keenly alert to changing conditions and new problems, which in these days are arising almost kaleidoscopically.

Fundamentally, the basic principles of good leadership do not change, although it is true that science and research are continually throwing more and more light on better methods and practices in dealing with the human element in an organization. A few rare souls seem to sense the secrets of good management. Even they can improve their ability, however, by keeping in touch with the progress which is steadily being made in our understanding of the art of personnel management and industrial leadership.

The Mechanical Engineer and Defense Transportation

(*Continued from page 5*)

a railroad had stopped applying new fireboxes and adopted the practice of patching until, after a time, many of the fireboxes on that road had become but a mass of patches. While recognizing the necessity of patching good fireboxes, particularly near the mud ring, Mr. Hall said that the result of his investigation of that particular road developed that more steel had been used in patching fireboxes than had previously been used in applying new ones.

P. W. Kiefer, chief engineer of motive power and, rolling stock, New York Central, reviewed the work of the A. A. R. in standardizing car design and K. H. Nystrom, mechanical assistant to chief operating officer, Chicago, Milwaukee, St. Paul & Pacific, made the suggestion that the use of welding could and should be extended during this emergency to speed up many of our maintenance and reclamation operations. Mr. Nystrom also ventured the suggestion that by careful planning a railroad could keep bad orders below 1.5 per cent. He said, "We can utilize freight cars to a still greater extent than we have up to the present time and obtain more miles per car per day with less cars unservicable. Mr. Nystrom also said he believed that the unservicable locomotives could be reduced to approximately half of the present 16 per cent. In commenting on this he recognized the present large percentage of unservicable locomotives as being of the older type. The question of materials and the ability to get them entered almost all discussions and the priorities system came in for its share of comment. One speaker said that reclamation should play a larger part in the immediate future and material which fails to meet specifications should not be rejected if it could be reclaimed. The attitude which railroad men might well take toward the priority system was rather well summed up by C. E. Smith, vice-president of the New Haven Road when he said, "we must get materials and we are going to get them, not solely by the harsh application of priority ratings because that cannot be done. We have got to get them by 'give-and-take'. You have heard that the priority system will be supplemented by an allocation system in cases where priorities would give all available materials to defense industries and this would deny the same material to other industries vital to defense that need them just as badly. Insofar as the railroads are concerned that job of give-and-take has been pretty well done to date."

C. C. Bailey, General Electric Company, summarized the job that all railroads will have to do from now on when he said, "in order to keep on keeping trains moving without delay maintenance and inspection should be even more exacting. Catching up with defects before they happen will make things last longer with fewer headaches. Concluding his remarks, along this line, Mr. Bailey said that turning an engine in two or three hours may build up a fine looking statistical record but if the road delays on the other side of the ledger indicate that the inspector overlooked serious defects, it is not very good railroading.

D. S. Ellis, chief mechanical officer, C. & O., said that in making use of substitute materials it should be borne in mind that no changes be required in the basic design if possible.

In commenting on the question of standardizing locomotives H. H. Urbach, mechanical assistant to executive vice-president, C. B. & Q., said that he would rather think in terms of standard locomotive parts rather than of entire locomotives. He questioned the advisability of developing standard locomotive designs.

Andrew Stevenson, chief of the Agricultural, Automotive, and Railroad Section of the Division of Civilian Supplies, O. P. M., suggested that in selecting substitute materials care be taken to insure that the substitutes themselves are not soon to become scarce. He commented particularly on the large requirements for copper in the manufacture of brass shell casings and suggested that anything the railroads could do to reduce the amount of brass required in journal bearings, or, alternatively, to help find some satisfactory substitute for brass in shell casings would be generally helpful.

John Dixon, president, Lima Locomotive Works, said that during the last war ten months were lost in the development of standard designs by the United States Railroad Administration, and expressed his approval of the A. A. R. proposal to limit locomotive orders to existing designs. The builders, he believes, will be willing to exchange existing patterns, dies, and drawings.

Frederick E. Lyford, trustee, N. Y. O. & W., said that he did not believe that we had as yet done the best with what we have available, citing the great difference in the freedom from engine failures and hot boxes which frequently can be found on immediately adjoining railroads. Speaking of the possibilities of more intensive utilization of equipment, he called attention to an increase of 9 per cent in locomotive miles per day on the N. Y. O. & W. during 10 months of 1941 over the same period for 1940.

Lawrence Richardson, mechanical assistant to vice-president and general manager, B. & M., cited examples of how common sense and ingenuity in departing from standards of loading and track alignment had permitted the movement of marine boilers over a route of restricted clearances.

Stresses in Car Wheels

(*Continued from page 14*)

Furthermore, the rosette gives the stress at the point of its location and four such rosettes equally spaced around the ring should give an accurate measure of the average stress in that ring. However, none of the values determined from the rosettes even approach the tangential stress indicated by the ring method. Since the rosette method is unaffected by the bending stresses and other effects that interfere with the ring method the former is to be preferred. As a matter of fact the ring method gives misleading results.

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EDITORIALS

For Our Country

The problem of financing national defense and the war and keeping our economy in proper balance, is one of no mean proportions. The Treasury Department at Washington has given this matter critical study and believes that it is quite essential that the public at large purchase defense bonds and stamps to the limit of the ability of every individual in the nation. This will enable each one of us, also, to have at least a small part in helping out in the grave emergency which confronts the United States.

A statement, elsewhere in this issue, explains and outlines a plan that is being urged by the Treasury Department, and in the promotion of which we can be helpful. Where it is not available contributions can be made in other ways. The *Railway Mechanical Engineer* urges its readers to do their part in promoting the sale of defense bonds and stamps. Bonds cost as little as $18.75 and stamps are obtainable in denominations as low as ten cents. Every cent counts!

Contest Closes January 15

Don't forget to mail your contribution to our prize competition on "ways and means of improving the mechanical department's operations or practices to increase production and secure a larger use from the equipment and facilities." Articles that are mailed on January 15 and bear a postmark before midnight of that day, will be eligible.

This contest, first announced in our October, 1941, issue, is of even greater import now that our country has been drawn into the Second World War. The material situation, which is growing more and more stringent as the months pass, has proved to be a bottleneck in the production of much needed cars and locomotives. Authorities at Washington seem to recognize the prime importance of the railroads in the emergency, and the indications are that they will do what they can to assist the railroads by diverting to their needs some of the scarce materials that are now so much needed for defense and war purposes. Not too much should be expected in that way, however, and special efforts must be made to secure a greater and more effective use of such facilities and equipment as are now available. This cannot be achieved by ordinary methods or the usual practices. It will require real ingenuity and the hardest kind of effort.

We hope that the contest has already proved of material benefit by stimulating thinking and effort in the right directions. We are hopeful, also, that the suggestions that will come to us will be of such a practical nature, from the standpoint of quick relief or benefit, that their application will help materially to still further increase the efficiency and effectiveness of the mechanical departments of our railroads.

More Intensive Freight-Car Use Essential In the New Year

An authoritative spokesman of the Association of American Railroads recently made the statement that the average freight car is in motion about 2½ hr. out of 24, which is a utilization on a time basis of only slightly over 10 per cent. Obviously, therefore, the important thing about freight cars is not so much how fast they are operated in trains on the road, but what happens to delay them at yards, terminals, repair shops, shippers' tracks, etc. Concentrated attention to every detail of freight-car non-operating time is essential if this percentage utilization is to be brought anywhere nearly up to the point where it should be. The indications are that railways will find it difficult or impossible to secure all of the new freight car equipment which they want in 1942, and if freight cars could be kept on the move only one-half hour more per day on the average, it would apparently have the effect of increasing the freight car inventory 20 per cent.

Railway motive power officers play an important role by providing adequate motive power in condition to handle trains safely at modern high-operating speeds; also by supplying ample switching locomotives for the prompt handling of cars at terminals and industry tracks, the switching movement not being made so fast, however, that cars are damaged and subsequently delayed for repairs. In the field of train operation, locomotive crews and their supervisory officers have a grand opportunity to increase the service secured from freight cars by the exercise of good judgment in minimizing delays as well as maintaining high sustained speeds while in operation.

By and large, however, the more effective use of freight-car equipment is dependent primarily upon the efficiency of car-department forces charged with the responsibility of freight-car design, inspection and maintenance. Car men can perhaps do more than any other single group by a concerted effort to increase the daily mileage and utilization of freight cars. The things which need most to be done have been emphasized officially several times in recent months but nowhere more concisely and pointedly than in the address "Reminders for Better Railroading," presented by C. J. Nelson, superintendent of interchange, Chicago Car Interchange Bureau, at the November 18 meeting of the Car Department Association of St. Louis, when he received the honor award given annually by this Association for distinguished achievement in the car field.

Mr. Nelson said that of about 36,000,000 cars loaded with revenue freight in the United States in 1940, over 1,000,000 of that number, not counting disarranged loads, were received in interchange in such condition that they had to be shopped for repairs. In the Chicago terminal, this ratio was 1 in 40 in 1932, and an intensive campaign has now reduced it to 1 in about 130, which still leaves plenty of room for improvement.

An inspection of defective material removed from loaded cars indicates that at least 50 per cent of the defects which necessitated shopping, were in existence before the cars were loaded. The answer to this problem rests largely in the inspection of empty cars with the same exacting care as loaded cars at interchange points. Another great improvement which can be made is in the shopping of fewer loaded cars when received in interchange with minor defects which have little if any bearing on safe operation. The ratio of loaded cars shopped to those received varies from 1 in 30 on some connecting carriers to 1 in 600 on others. If railroads with the low ratio mentioned are following the correct inspection practice, as would seem to be indicated by general freedom from difficulty in getting the loaded cars through to destination, it is obvious that car supervisors and inspectors on railroads with the high ratio are placing too much emphasis on technicalities of the rules of interchange and, in an effort to avoid personal responsibility and possible criticism, are overlooking their main duty which is to transmit loads to destination with the least possible delay consistent with safety. It is evident that an intensive campaign of instruction and morale building is required if these car supervisors and inspectors are to function with maximum efficiency in avoiding delays to loaded cars.

A large proportion of all loaded cars shopped for repairs have to be taken out of service due to defective wheels, chill wear being responsible for most of the necessary wheel changes. The recent action of the A. A. R. in adopting a gage to show definitely when a worn-through-chill car wheel shall be removed and when it shall not be removed from loaded cars, should prove a very effective action in preventing delays to loaded cars. The effect of this gage is to reduce the condemning limit to $\frac{3}{64}$ in. wear in the case of loaded cars and give car inspectors a gage, the use of which will practically eliminate entirely the judgment feature.

The improper loading of open-top cars is another source of delay and loss of life and property, which should be analyzed and steps taken to remove the contributory causes which consist primarily of a lack of knowledge of the A. A. R. loading rules, both by shippers and many railway employees, and the fact that the competitive feature enables unscrupulous shippers to play one railroad against another and thus sometimes cause the acceptance of questionable loads for movement in high-speed freight service. No one contends that the A. A. R. loading rules are perfect and they are constantly in the process of being reviewed and revised in certain details which need to be improved. There is no excuse for partiality, however, and when steel shippers, for example, receive dangerous loads of scrap iron, not secured in accordance with the approved loading rules, they naturally ask why the railroads are so exacting with steel shipments and sometimes so lenient with loads of scrap iron.

The specific recommendations in Mr. Nelson's paper deserve more than consideration and study. They should be acted on promptly to make sure (1) that greater efforts be made to keep empty cars in suitable repair for carrying loads to destination without being shopped enroute; (2) that no loaded cars be shopped unless absolutely necessary for safety or compliance with the law; (3) that chief mechanical officers keep records of all loaded cars shopped on their respective systems, with the view of keeping constant checks for improved performance; (4) that car supervisors ascertain, beyond doubt, that all employees having to do with the loading of freight cars are fully familiar with the A. A. R. loading rules; and (5) that agreements be made to the effect that, at points where two or more railroads serve one and the same shipper, cars or loads rejected by one railroad will not be accepted by another.

Two Car-Department Responsibilities

In the course of an unusually pertinent discussion of freight-car loading rules at a recent meeting of the Northwest Carmen's Association, M. E. Fitzgerald, master car builder, Chicago & Eastern Illinois, emphasized two primary responsibilities of railway car departments, namely: To inspect cars and see that they are in suitable condition to carry loads to destination; also to inspect loads and see that they are properly and safely secured before being accepted from the shipper. Both of these responsibilities do or should belong definitely to the originating carrier and, as Mr. Fitzgerald so clearly pointed out, if they are fairly met, most of the current pressing problems associated with

the interchange of cars and the safe movement of freight shipments will be solved.

The trouble is that much remains to be done in the instruction of both car inspection forces and shippers. Many of the former do not have a full understanding of the distinction between car conditions absolutely essential for safe operation and those which need not be so highly stressed when it is a question of getting loaded cars through to destination without the delay and cost incident to sending them to repair tracks. It is said that some shippers do not even have copies of the A. A. R. loading rules which, in themselves, are subject to constant revision in the interests of more safe and efficient loading. Apparently the products now causing particular difficulty in shipment include long poles, logs and lumber loaded on open-top cars; steel billets, sheets and pipe; heavy machinery, whether pivoted or not; scrap iron; and various commodities shipped in tank cars which are not always loaded in accordance with I. C. C. regulations.

It cannot be questioned that many thousands of dollars, expended by the railroads today for freight claims, transfers or adjustments, to say nothing of train delays, as a result of continuing defective or obsolete cars in service, could be more profitably utilized in repairs or for new equipment. Mr. Fitzgerald commented on this feature and closed his paper with the three following suggestions: See that only good cars are set for loading; study industry requirements on the respective lines and see that individual shippers have copies of the loading rules and are familiar with the latest requirements governing shipment of their commodities; and train special men at large terminals to supervise industry loading and be available for sending to smaller points on advance notice that commodities involving special difficulty in handling are to be loaded.

Standardization — Now and Twenty-Five Years Ago

One of the most frequently mentioned subjects at the railroad sessions of the annual meeting of the American Society of Mechanical Engineers, in a discussion of railroad transportation during the national emergency, was standardization of freight cars and locomotives. The prevailing opinion was favorable to a method of dealing with the need for conservation of materials, time, and shop facilities which disturbs the status quo and the exercise of free choice on the part of the railroads as little as possible, although there are still those who would like to see steam locomotives reduced to standard types as was done by the United States Railroad Administration during the first World War.

So far as it affects the amount of materials and builders' plant capacity required, the present situation is far more acute than that at the outset of our entrance into the first World War. The present approach to this problem, however, has been of a far simpler and less disturbing nature than that during the last war. Then, the United States Railroad Administration appointed committees representing the builders to study the question of standard designs of both freight cars and locomotives during the summer of 1917; these committees reported early in 1918 with recommended designs from which, after they had been submitted to committees of regional officers of the Railroad Administration for comment and criticism, orders were placed with the builders at the end of April. Freight cars built on these orders began to come out of the plants in quantity in September and deliveries on orders from only three of the twelve standard locomotive types had been made by that time.

The United States declared war on Germany on April 6, 1917. It was seventeen months later before equipment on U. S. R. A. orders were delivered in quantity. Our participation in the war lasted a few days more than nineteen months.

In our present war emergency, with its tremendously greater demands upon our industrial system for the production of the implements of war, had any such process of standardization been undertaken, it is probable that the materials for the building of railway cars and locomotives would have ceased to be available before the first orders could be placed. Indeed, to wait for equipment while the process of developing standard designs ran its tedious course would probably prove fatal to the adequacy of railway transportation.

Of course, we are not entirely without standard designs at the present time. There is the 40-ft. 6-in. steel-sheathed wood-lined box car adopted as standard by the A. R. A. in 1932, followed by 50-ton and 70-ton hopper cars, another 40-ft. 6-in. box car of increased dimensions, and a 50-ft. 6-in. box car of large interior and clear height dimensions—all cars, the designs of which have been widely accepted by the railroads. For the remainder of the thirteen designs to which the railroads have pledged themselves to confine their freight-car orders during the emergency, no accepted standards are available. To meet the needs for cars of these types the Association of American Railroads has taken a common-sense course of accepting existing designs for which patterns, jigs, templates, etc., are already available. It has, in effect, accepted these existing designs as temporary standards.

In the case of locomotives, which do not go into interchange, not even this degree of standardization has been adopted. Confining future orders to existing designs and combining small orders meets the essential requirements of the builders and of material conservation.

The highly important fact in the present situation is that the ordering of material and building of equipment need in no case await the development of a design and material requirements can be quickly and accurately estimated.

St. Louis Refrigerator Car Shop Kinks

A number of labor-saving devices used at the St. Louis, Mo., shops of the St. Louis Refrigerator Car Company, are shown in the illustrations. Referring to the first view, floor racks are made on a table jig, the top boards being cut to length by an electric hand saw and the completed rack lifted with the monorail and chain hoist to the storage position, illustrated. While suspended in the air the floor racks are sprayed with a mineral red paint. From the storage position, the floor racks are again lifted with the chain falls, pushed out of the shop on the monorail extension shown in one of the photographs and

Monorail hoist used in handling floor racks at the St. Louis Refrigerator Car Company's shops

loaded on a truck for removal to the individual refrigerator cars where they are to be used.

These floor racks are made of oak and each unit weighs approximately 400 lb., requiring four men to handle it readily without the use of a mechanical hoist. The monorail hoist is made of a 6-in. I-beam, equipped with a ½-ton chain hoist and extended out of the shop 10 ft. to permit loading trucks or trailers placed on the cross walk at the end of the shop.

Referring to the second view, a universal portable variety saw, made by the Crescent Machine Company, Leftonia, Ohio, is being used for combination rip or cross-cut sawing at any point wherever needed throughout the shop. This saw is driven by a 7½-hp. electric motor with a 25-ft. cord extension to be plugged in at any convenient socket. The saw itself is 18 in. in diameter, with teeth cut for either rip or cross-cut sawing and protected by a totally enclosed safety guard so that it may be used with safety by any car man who has a quick job of sawing to do.

The principal advantage of this portable saw is that it may be located adjacent to a pile of lumber and used for squaring and cutting off siding, flooring, lining, roof sheathing, etc., without the necessity of loading this lumber on a truck, moving it to the mill, unloading it, sawing, re-loading and moving it to the car. Instead, the lumber is simply moved directly from the pile, one piece at a time to this portable saw, from which it is loaded on a truck and in a single additional movement placed ad-

Crescent universal portable variety saw which saves time on many small sawing jobs

jacent to the car on which the lumber is to be applied.

All that is necessary in moving this portable saw is to pull out the two wooden handles, illustrated, press down and engage a notch which puts the wheels in rolling position and then reverse this operation after the saw has been located where it is to be used. The 25-ft. electric extension cord may be plugged into an ordinary socket at any post throughout the shop.

Considerable thought has been given to every phase of lumber handling to reduce the manual labor and also save unnecessary steps at the St. Louis Refrigerator Car Company's shop. With this shop located in the center of an extremely busy manufacturing district in St. Louis, storage space in the lumber yard is at a premium and lumber is handled and piled in such a way as to utilize this space to the maximum advantage and also conserve the physical efforts of the yard crew which does the work.

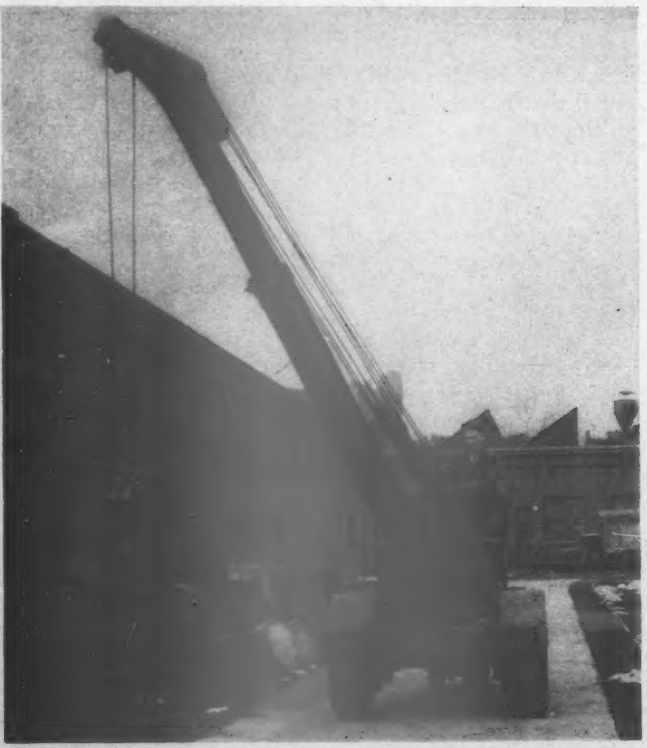
For example, roller conveyors, shown in one of the

Roller conveyors are a great labor saver in unloading cars of heavy lumber

illustrations, are used effectively to reduce the labor in handling lumber from the incoming car to the storage piles. Heavy oak timbers are received in various sizes from 3 in. by 3 in. up to 8 in. by 8 in., and 9 ft. long, all frequently loaded in the same car and now very easily and conveniently unloaded by means of the roller conveyor sections, illustrated. The first roller section is placed on horses with one end extending into the car door and the other intersecting cross sections which are inclined, usually both ways along the aisle between lumber piles so that timbers of various sizes may be directed either to the right or to the left, dependent upon the direction it needs to move for storage in the lumber pile of that particular size. With one man in the car and one or more available to take away from the roller conveyor, a car can now be unloaded and the heavy timbers placed in their respective piles in a fraction of the time formerly required.

The roller sections are available in different lengths up to 20 ft., being made of 2-in. side angles with 3-in. ball-bearing rolls, 18 in. long, spaced on about 8-in. centers. The use of these roller sections saves a large amount of work in lifting and carrying heavy timbers which, particularly on hot days, men find it difficult to perform continuously without mechanical assistance.

The other two illustrations show a Krane Kar, Model A, gasoline-operated machine, two of which are used for



Another view of the Krane Kar moving one of the metal drums filled with scrap steel

a great variety of operations at the St. Louis car shop, including the lifting of heavy material, loading and unloading cars of bulky materials, spotting cars, hauling trailers, etc. Each machine is equipped with a 12-ft. boom having an extension of an additional 6 ft. available when needed. It is designed to lift 5,000 lb. at 3½ ft. radius and owing to the use of small closely spaced double-rear wheels is designed to turn in its own length. The effectiveness of the Krane Kar has been greatly increased at the St. Louis car shop during the last 12 months by the installation of concrete walkways, one of which is shown in the illustration.

Wood refuse box being dumped by a gasoline-operated Krane Kar with 18-ft. boom

In one of the views, a wood refuse box is shown being unloaded into a scrap car. This box is one of several, 4 ft. wide by 18 in. high by 9 ft. long, having one end open and being equipped with a ring at each corner for attachment of the four-chain hook and ring which engages the crane hook. With these refuse wood boxes located at convenient points throughout the shops, scrap wood and refuse is thrown into them instead of on the floor and when the boxes are filled, they are taken one at a time to the scrap car where the release of the two forward chains enables the Krane Kar operator to dump the box without additional help and thus save an awkward hand-unloading job.

Similarly, "one-trip" sheet metal drums are located conveniently throughout the shops to receive scrap iron which is moved to the scrap yard and loaded into the car directly from the drum without re-handling, regardless of weight. Two holes are punched in the side of the drum near the top for attachment of a double crane hook so that the Krane Kar can readily lift the drum and handle it to the scrap car. Punchings, rivet heads and springs are placed in one drum, cast iron in another, malleable iron in another and in this way considerable labor is saved in sorting the scrap material. Bolsters are handled two at a time with this crane, the weight being about 1,200 lb.; also four couplers weighing 1,600 lb. The metal drums when loaded with scrap iron or steel castings weigh from 500 to 800 lb.

Passenger Car and Coach Yard Sanitation

*By N. J. Capaldo**

In the cleaning of passenger cars one of the most important requirements is sanitation, which might be classified as the health department work of the railroad.

* Clerk and extra-gang foreman, Terminal Railroad Association of St. Louis. Mr. Capaldo's paper, abstracted above, was awarded first prize as the best of seven short papers presented by car men from the ranks before the Car Dept. Association of St. Louis during the last year.

Now many of us have ridden on the passenger carrying equipment of a railroad and have taken it as a matter of course that the cars would be cleaned, watered and in a sanitary condition, but how many have given thought to the great care and the requirements which are necessary to keep passenger cars in a sanitary and healthful condition. It is my observation that the traveling public after boarding a car and having selected a seat, invariably have a desire to get a drink of water. The first thing they see is the sanitary paper cups in a sanitary holder next to the drinking-water container. In drawing a cup of water the public, as a whole, does not give thought to the fact that the railroads are always on the alert and ever watchful to see that the water supplied cars for public consumption is the purest, yes we might even say that it is purer than city water. In supplying passenger cars with water we of course use the water furnished by the city, which is put in the cars with a water hose, the nozzle of which is always capped when not in use. The water is put into tanks on the cars from which it is diverted for the various uses, such as toilets, wash stands and drinking fountains. The water to the drinking fountains is piped to a filter in the fountains through which it passes to the outlet; therefore you can readily see that the railroads re-filter the pure city water before passing it on to the public. Now, in order to maintain the filters and coolers in a first-class sanitary condition, it is necessary that we remove the filter stones at least once each week and thoroughly steam and clean them on the steam table which is solely provided for this purpose. I am satisfied however, that we can make some further improvement in the drinking-water arrangement. I believe that a mechanical cooling system for drinking water fountains can be devised along the line of the air-conditioning system, which no doubt would result in a saving of both labor and material.

Fumigation Equipment Suggested for Each Car

With the advent of the air-conditioned cars, the railroads have further contributed to the health of the public, not only by the cooling of cars in warm weather and heating of cars in cold weather, but by the continuous circulating of fresh pure air throughout the cars. However, because food is brought in by passengers, the cars may become more or less infested with vermin and flies. This has to be overcome by frequent fumigation with an insecticide and a mechanical or electric spray gun. This we find to be very effective in the eradiation of all vermin. However, as the insecticide used is in liquid form, and the mechanical or electric guns have connections outside of the car, provisions could be made in one end of the car whereby the insecticide and spray gun could be placed and made a part of the car equipment. The cars then could be fumigated by the regular car cleaner at each end of the line and just prior to the cleaning of the car.

In recent years railroad coach travel has greatly increased due in a large measure to lower rates, modern de-luxe equipment and the many innovations offered by the railroads. One of the many inducements offered to night coach passengers is the free pillow service, an inducement that is very popular with the traveling public. However, it has been my observation that after the use of these pillows, some of the slips were soiled from perspiration, oily substances, dirt, etc., and in some cases this has penetrated into the pillows. Clean pillow slips alone do not restore satisfactory sanitary conditions as it is a fact that heat from individuals who might be resting their heads upon the pillow would have a tendency to draw from the pillow any substance or disease that might have penetrated into the pillow. A suitable covering such as cellophane or a similar material that is non-porous and will not crackle, used to cover the pillow ticking proper, would be ideal from a sanitary point of view.

There are many more functions for the maintaining

Two-wheel container and cover used in disposing of dining car garbage in a coach yard

of sanitary conditions in railroad cars, such as the disinfecting of toilets, the mopping of floors, the cleaning of wash stands, flushing of water tanks etc., which in my opinion could be classified as necessary health precautions of the railroads.

In the interest of sanitation, it would be my recommendation that toilets, both men's and women's, should be increased in size and constructed in such a manner to effect perfect ventilation; side walls and floors and fixtures be of materials that can be easily cleaned; hoppers be set out from the wall sufficiently to permit cleaning behind them more easily.

All coaches and chair cars should be completely covered with floor covering of rubber tiling or linoleum, for sanitary reasons, and to cut down on expense of keeping painted floors in proper condition.

Steam heating pipes should not run behind hoppers, as it creates a condition that is almost impossible to clean thoroughly.

Windows should be arranged so that they can be completely opened for cleaning and I would recommend that a piano hinge arrangement be used for this purpose, so that the windows can be opened from the inside and thus permit thorough cleaning of the windows. This would do away with the present method of using jacks to open windows, which mars the window sills and eventually necessitates refinishing.

I would also recommend what I believe would add to the safety of the traveling public, in the following suggestions:

Four Specific Suggestions

Vestibule steps should be made standard both for width and tread, and the amount of each, i. e., all steps to

have either four or five treads. This standardization I feel would add to the safety of not only passengers, but to carmen and car cleaners who make many trips in and out of cars.

Thought should be given to the proper floor lighting of all cars, particularly of aisles, in order to furnish sufficient illumination for safe walking, especially at night or when the top lights are dimmed.

Spacing of seats in cars should be sufficient to allow for the comfort of passengers. This would eliminate the use of the back of seats for foot rests and would provide in some degree, room for small luggage.

In the narrow hallways, where cars are equipped with smoking or rest rooms, entrances should be of sufficient width to permit carrying luggage through without marring partitions or side walls. If this cannot be done, materials should be used on the side walls that will not dent or scar. Experience has shown how expensive it is to keep painted surfaces in presentable condition.

Air Brake Questions and Answers

(AB-8, Empty and Load Equipment Continued)

65—*Q.—What position is the change-over piston in and what keeps it there?* A.—Spring *25* moves the latch piston to the locking position, causing latch *27* to move to a position which will retain the change-over piston in the empty position.

66—*Q.—What possibilities are there of false changes in setting while the car is in motion?* A.—None. The strut cylinder piston spring *5* raises piston *3* and attached shoe *6* away from contact with the piston stop.

67—*Q.—How is the air vented from the face of the large change-over piston?* A.—When the strut cylinder piston is moved to its upper position, the port connecting with pipe *4* is therefore connected to the atmosphere through an exhaust port and the wasp excluder fitting.

68—*Q.—Where is this exhaust port located?* A.—In the non-pressure end of the strut cylinder.

69—*Q.—In the event that an uncharged car is connected to a charged brake pipe, does the change-over valve have sufficient time to assume its proper position?* A.—Yes. There is a choke, *103,* in the change-over valve pipe bracket which serves to provide a predetermined time for charging the strut cylinder volume. This arrangement gives the change-over valve the required time.

70—*Q.—On the AB quick service and emergency transmission, what provides against any slowing up effect of pipe 11 on this transmission?* A.—Choke *25* (Fig. 4) in the ABEL-1 valve bracket, connected to this pipe, provides for such a contingency.

71—*Q.—Referring to Plate 3. With the change-over valve in the empty position, what position is the transfer valve in during a brake application?* A.—In its upper position, due to the force of its spring in addition to air pressure.

72—*Q.—What serves to hold the change-over slide valve on its seat?* A.—Air from passage *3* flows through passage *3b* to a diaphram which by means of strut *10* holds the slide valve seated.

73—*Q.—With the equipment in empty position, is there a possibility of pressure development in the load cylinder?* A.—No. Exhaust port *At* is connected permanently to change-over slide valve chamber *B,* which connects with passage *8,* leading to the load cylinder.

74—*Q.—In what direction does release take place in the event that the equipment is in empty position?* A.—In an opposite direction.

75—*Q.—When the brake pipe pressure is reduced below 30 lb., what must be done before the change-over valve changes position?* A.—Car loading must be changed.

76—*Q.—Referring to Plate 1. With the car more than half loaded, and the brake pipe pressure building up, is the operation of the cut-off valve and latch piston of the change-over valve similar to that of an empty car?* A.—It is the same.

77—*Q.—What serves to hold the piston and slide valve in load position?* A.—The truck member to which the strut cylinder is bolted is closer to the piston stop when the car is loaded, which reduces the travel of the strut cylinder piston. Such being the case, no air is admitted to pipe *4* as the piston does not uncover the port.

78—*Q.—Referring to Plate 2. Describe the "release and full charge" (load) position?* A.—After the brake pipe pressure builds up in excess of 30 lb., air pressure is vented from the change-over portion by the cut-off valve, and the latch holds the change-over piston and slide valve in load position until a change takes place in the loading of the car and the brake-pipe pressure is reduced again to below 30 lb. In load position of the change-over slide valve passage *7* is uncovered and connected to the slide valve chamber exhaust port *At.* This connects the brake cylinder volume in the change-over pipe bracket and the spring side, passage *7a,* of transfer piston *41,* to the atmosphere.

79—*Q.—Describe the brake application in "load" position.* A.—Referring to Plate 4. Air from the AB valve is connected to the empty brake cylinder until 20 lb. pressure is developed, which is sufficient to cause the transfer piston to break its upper seal and move to the lower seal.

80—*Q.—Is air free to flow at this time from the empty to the load cylinder?* A.—No. Due to the seating of check valve *47,* cutting off communication between the two cylinders.

81—*Q.—Is there any communication between the ABEL-1 valve and the load cylinder at this time?* A.—Yes. By way of the transfer valve and the change-over slide valve.

82—*Q.—When is check valve 47 unseated and what happens?* A.—When the pressure in the load cylinder is slightly more than that in the empty cylinder, air from the ABEL-1 valve is connected to both cylinders.

83—*Q.—What valve functions to admit air to the load cylinder in the event that the supply of air from the ABEL-1 valve is stopped?* A.—Release check valve *51* opens to permit air to pass from the empty brake cylinder through various passages and past the transfer valve to the load cylinder.

Maintenance of AB Empty and Load Equipment

84—*Q.—What instructions should be followed when cleaning the AB empty and load freight brake equipment on repair tracks?* A.—The same instructions and procedure as followed for cleaning and testing the AB brakes.

85—*Q.—What should each brake cleaning gang be provided with?* A.—A grease can so arranged that both the grease and brush can be protected against dirt, one extra set of shipping caps for the various valve portions; a blower hose and suitable tools.

86—*Q.—What kind of tools should be provided.* A.—Referring to Fig. 1 (Instruction leaflet No. 2391, Supplement 1). A combination socket wrench set for AB valve portions, flange fittings and brake cylinder non-

pressure head. This set consists of a ratchet-type handle, two extensions, a universal joint and five sockets, viz. $\frac{9}{16}$ in., $\frac{5}{8}$ in., $\frac{3}{4}$ in., $\frac{13}{16}$ in. and 1 in. (The $\frac{13}{16}$ in. socket is required only for the empty and load change-over valve); a strainer nut wrench, and open end S wrench with $\frac{3}{4}$ in. and $\frac{13}{16}$ in. openings for dirt collector branch pipe tee and cut-out cock; a blower nozzle valve with suitable $\frac{1}{4}$ in. pipe nipple nozzle for blower hose; a vent protector plug (Fig. 3) and suitable scrapers.

Two Straightening Devices

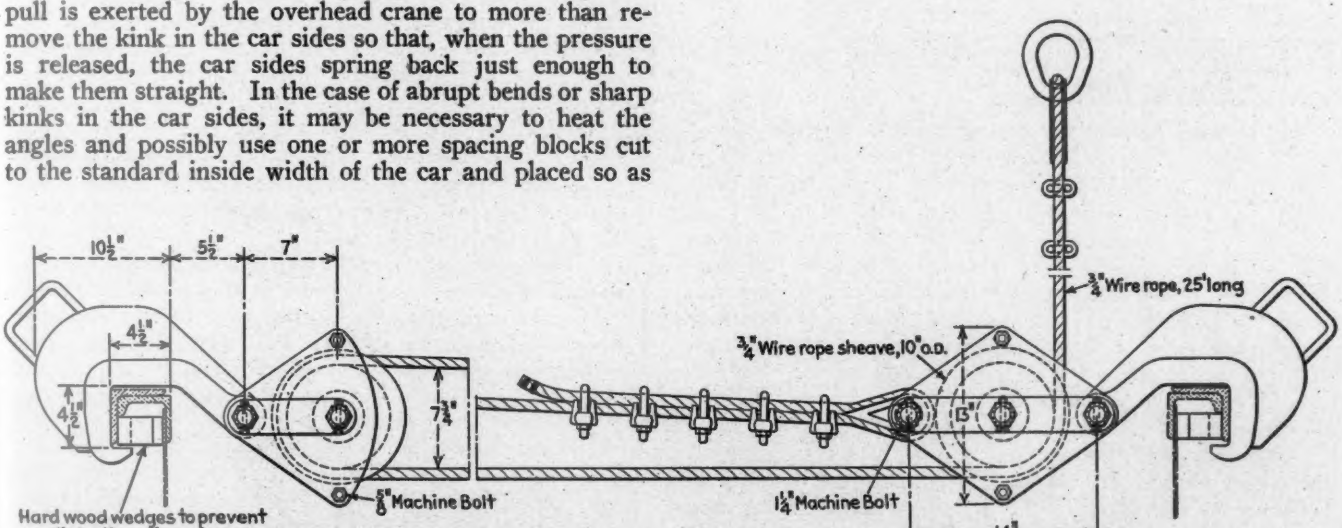
Two convenient devices, for straightening steel car sides and end gates, respectively, are shown in the drawings.

When the sides of a steel gondola car are bulged outward due to overloading, abuse with a clam shell while unloading, or any other cause, they may be easily straightened and brought back into the correct alinement by means of the device shown in the first drawing. This consists of two heavy hooks, bolted to single-sheave pulleys which are connected by a double strand of $\frac{3}{4}$-in. wire rope in such a way that the upward pull of a shop or locomotive crane on one end of the wire rope exerts twice that amount of pressure in pulling the car sides together.

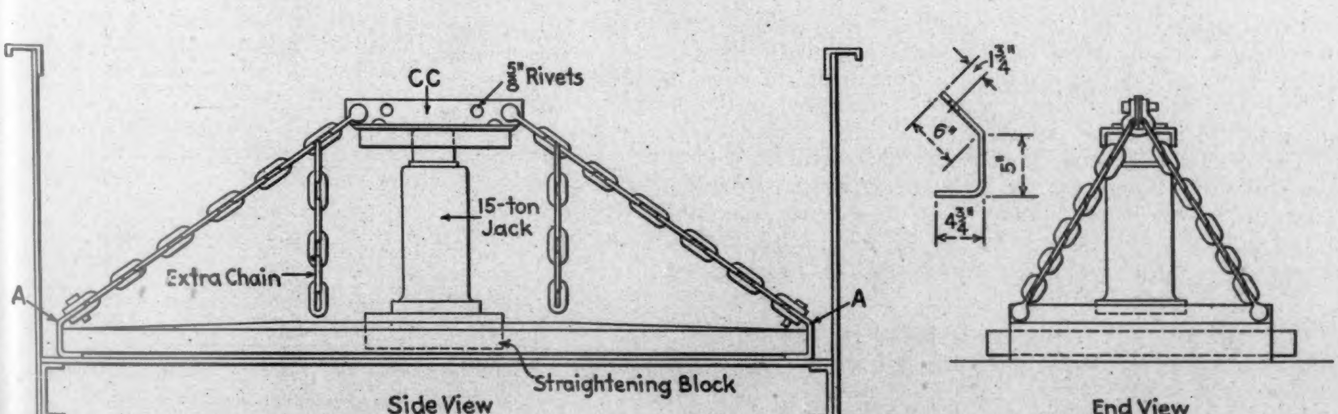
Hardwood wedges are applied, as shown in the drawing, to prevent distortion of the car side angles over which the large hooks are placed. Sufficient upward pull is exerted by the overhead crane to more than remove the kink in the car sides so that, when the pressure is released, the car sides spring back just enough to make them straight. In the case of abrupt bends or sharp kinks in the car sides, it may be necessary to heat the angles and possibly use one or more spacing blocks cut to the standard inside width of the car and placed so as to bring the pressure on the car sides just where it is needed.

The single-pulley sheaves, with 10 in. outside diameter and $7\frac{3}{4}$ in. groove diameter, have a $1\frac{1}{4}$-in. bore and a $1\frac{3}{4}$-in. hub length, being equipped with self-lubricating bushings. For safety and ease in handling, the hooks are equipped with welded hand holds made of $\frac{5}{8}$-in. round steel. The cable is 25 ft. long, is anchored to a pulley block at one end by means of wire rope clips and a thimble, and is equipped with a wire rope thimble and elongated steel ring at the other end for attachment to the overhead crane.

Referring to the second drawing, it will be noted that the 15-ton jack and special chain equipment shown can be readily used for straightening the end gates of drop-end gondola cars. Two hooks, made of $\frac{3}{4}$-in. steel plate, 36 in. long, are bent to the shape, shown at *AA* and placed under the edges of the bent door. Two connector angles *CC*, made of $3\frac{1}{2}$-in. angles 23 in. long, are placed back to back and drilled with $\frac{11}{16}$-in. holes near each end for the attachment of $\frac{3}{4}$-in. clevis and chain connection to hooks *AA* at each corner of the door. The angles *CC* are riveted to an 8-in. channel, 21 in. long, which is supported on the ram of the jack, the base resting on a 3-in. by 4-in. straightening block which has rounded corners and fits in one of the corrugations of the end gate. By exerting as much pressure as may be required with the 15-ton jack, shown in the drawing, the end gate can be readily straightened in a minimum time, and without removing it from the car.



Device which may be effectively used in straightening the sides of steel gondola or hopper cars



Device for straightening bent end gates without the delay and expense of removing them from the car

Improved Method for Checking

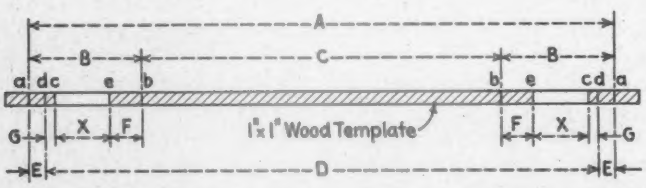
Alignment of Running Gear*

Part II

Checking Driver Lateral to Determine Thickness of Hub Liners on Boxes

With the driving box centers properly squared and the shoes and wedges laid off, the correct alignment of the driving wheels depends on the correct thickness of the driving box hub liners. This is determined from the long straight edges on which all alignment and squaring operations are based.

The method of checking the driver lateral to determine the hub liner thickness is shown in Fig. 7 and is



A—Distance between outside edges of long straight edges shown in Fig. 1.
B—Distance from outside edge of long straight edge to outside face of pedestal.
C—Distance between outside pedestal faces.
D—Distance between hub faces on driving wheels.
E—Equal distance from outside edge of straight edge on each side.
F—Thickness of shoe and wedge flanges.
G—One half total lateral allowed on drivers.
X—Thickness of driving box hub liner.

Fig. 7—Wood template for checking lateral to determine hub liner thickness

performed for each pair of drivers at its frame pedestal. A wooden template approximately 1 in. by 1 in. in size, with length to suit, is used for this purpose. Lay off on the template the distance *A* between the outside edges of the long straight edges and mark points *a*. From these points, lay off distance *B* at each end from the outside edge of the straight edge to the outside face of the pedestal on each side and mark points *b*. Then *C* should equal the distance between the outside faces of the pedestals.

Assuming that the tires are correctly set to gage on the wheel centers, lay off on the template the distance *D* between the hub faces of the driving wheels, taking care to center this distance between points *a* and mark the two points *d*. The distance should be equal at each end of the template.

From points *b*, lay off *F* equal to the thickness of the flanges on the shoes and wedges and mark these points *e*. Lay off the distance *G* from points *d* equal to one half the total lateral play to be allowed on the drivers, and mark the points *c*.

The distance *X* between points *c* and *e* will then be the correct thickness for the hub liners on the driving boxes to secure proper alignment of the driving wheels.

Squaring and Checking Alignment of Engine or Pony Truck

The method of squaring and checking alignment of four-wheel engine trucks is shown in Fig. 8.

Remove the pedestal liners, wedge a wooden block between each pair of pedestal jaws, as shown at *B*, and locate the pedestal center on this board. Clamp a straight edge to the front and back pedestal jaws with its top edge an equal distance from the bottom of each jaw, as shown at *X*. Transfer all four pedestal centers from the wooden blocks to the top of the frame, by means of a try square set on the straight edge, and prick-punch as shown at *C*.

Set a straight edge to the prick punch marks at the top of the frame and scribe a line across the top of the frame, as shown at *D*, on both sides, front and back. Then prick punch new center points on this line an equal distance from the inside face of each pedestal as shown at *A*.

Check the diagonal distance between points *A* at opposite corners of the frame. If both diagonals are equal the frame is square.

Check the distance between the top and bottom of the jaw faces at each pedestal to see that the jaws are parallel.

Check the lateral across the opposite pedestals at the top, bottom and center, to determine if the frame is bowed or sprung vertically, prick punch a mark 1 in. from the pedestal face and 2 in. from the end of the face at the top and bottom at each end of the frame, as shown at *E*, on both sides. The distances between the two upper points should be equal to the distance between the two lower points on each side of the frame, if the frame is straight.

To check the location of the female center casting, it should be set at the true center of the rocker swing. This is accomplished by setting it mid-way between the centers which the rockers seek when released from their extreme travel position on each side. Care should be taken to see that the rocker displacement is not due

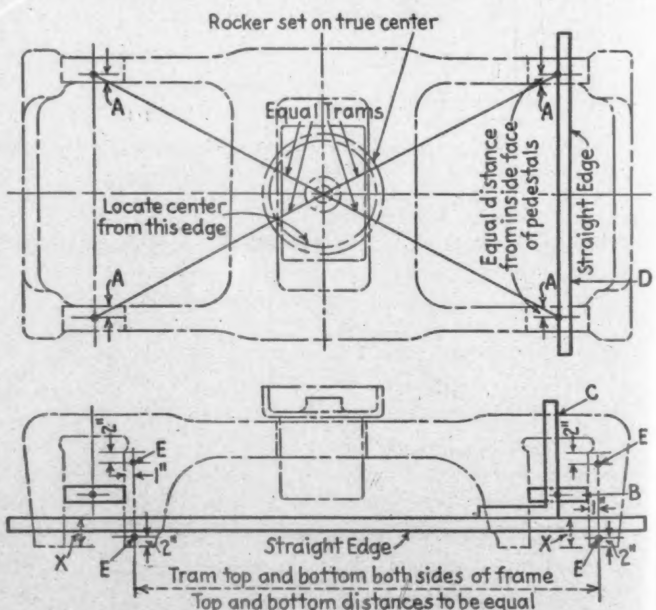


Fig. 8—Checking alignment of four-wheel engine truck

* Abstract of a report presented at the annual meeting of the Locomotive Maintenance Officers' Association at the Hotel Sherman, Chicago, September 23-24, 1941, Part I of which appeared in the December, 1941, issue.

to dirt or other foreign matter between the rockers and seats. When set, check with the tram from the pedestal center points *A*. All arcs scribed by the tram should intersect at a common point at the center of the female center casting.

As a further check on the center casting and rockers or swing links, level the frame crosswise and lengthwise and check the center bearing surface to see that it is level with the frame. The contours of the rocker surfaces should be checked with a suitable gage in order to maintain the correct lateral resistance of the truck on the curves.

The method of checking the alignment of a two-wheel pony truck is shown in Fig. 9.

The pedestal liners should be removed and the pedestal faces checked with a straight edge for being square and parallel. The truck frame is then leveled both crosswise and lengthwise.

Apply a straight edge, having adjustable center blocks, across the pedestal faces as shown at *A*. The correct

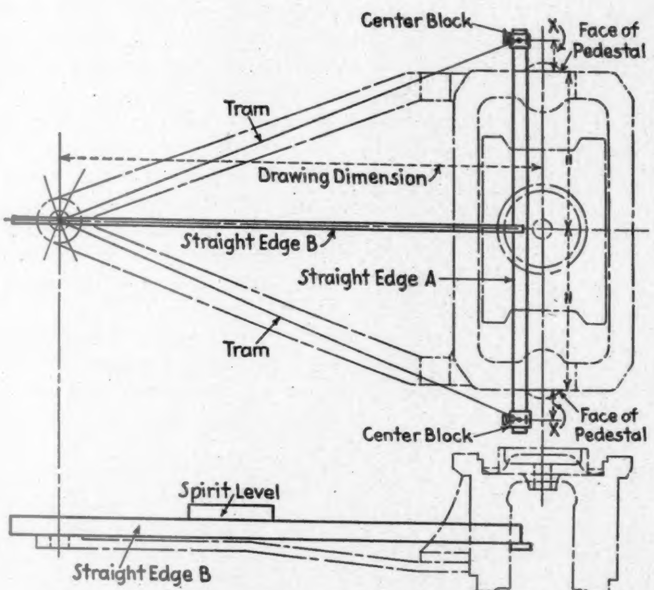


Fig. 9—Checking alignment of two-wheel engine truck

location of this straight edge is determined by laying another straight edge across its mid-point and the radius-bar pivot center, as shown at *B*, and raising or lowering straight edge *A* until straight edge *B* is level, as indicated by a spirit level. Straight edge *A* is then at the correct height in the pedestal. It should be cross-leveled and clamped in position after which the adjustable block centers should be set an equal distance *X* from the pedestal faces on each side of the frame.

Then tram from the black centers to the radius bar pivot. The arcs scribed by the tram should intersect close to the center of the pivot pin hole.

Check the location of the king-pin center for being centered in the truck frame and check the distance between the king-pin center and the radius-bar pivot center. This should agree closely with the drawing dimension.

Squaring and Checking Alignment of Trailer Truck

The method of checking the alignment of a two-wheel Delta-type trailer truck is shown in Fig. 10.

The truck frame should be leveled, the pedestal liners removed and the pedestal faces checked with a straight

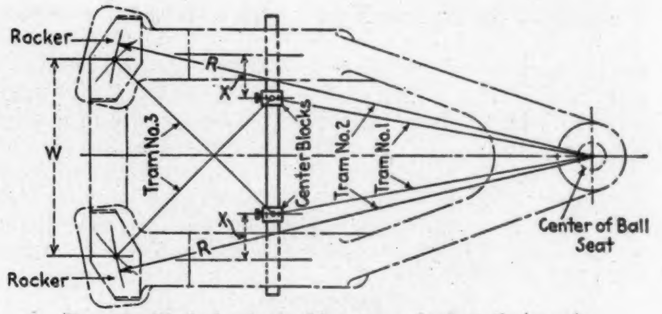


Fig. 10—Method of checking two-wheel trailer truck

edge for being square and parallel. Then apply a straight edge having adjustable center blocks, across the pedestal faces as shown. This straight edge should be leveled with the frame and the block centers adjusted to equal distances *X*, from the pedestal faces on each side.

Check the distance from each block center to the center of the truck pivot ball seat with tram No. 1 as shown. These distances should be equal on both sides. If not, the straight edge should be lined out from the near pedestal face until the distances are equal. The amount of adjustment should be so divided between the pedestals that the center line of the axle, when applied to the truck, will be parallel to the line of the adjusted straight edge.

To check the centering device, set the two rockers on their seats on the truck frame and mark the center of each rocker. Check the distance between the rocker centers *W* which should equal the distance between the rocker plates on the rear-end cradle of the locomotive frame. Check distance *R* from the truck pivot center to the rocker centers with tram No. 2 as shown, and scribe the arc on the rocker. These distances should be equal on both sides and should equal the distance from the pivot center of the rocker plates on the locomotive frame. Check the distance from the block centers on the straight edge to the rocker centers with tram No. 3 as shown and scribe the arc on the rocker. These distances should also be equal on both sides.

The arcs scribed by trams No. 2 and 3 should intersect at the rocker centers. If they do not the centering device should be shifted on the truck frame until properly adjusted. Also, the contour of the rockers should be checked with a suitable gage to insure maintenance and correct the lateral resistance of the truck.

The method of checking the alignment of a four-wheel Delta-type trailer truck is shown in Fig. 11. It is practically the same as the method described for the two-wheel truck, except that a second straight edge, with adjustable center blocks, is applied at the second pair of pedestals. The rocker locations are checked from the pivot-pin center and the block centers on the straight edge through the back pedestals.

Final Check

After the driving wheels are applied, wedges set up and pedestal binders applied and tightened, the locomo-

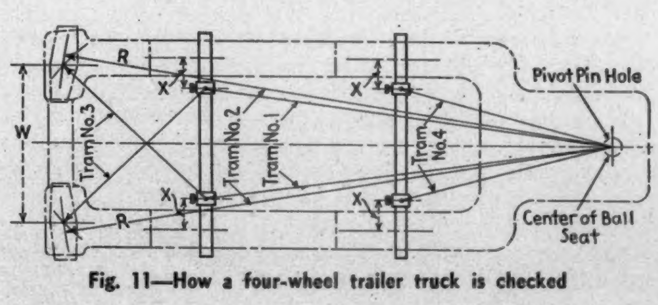


Fig. 11—How a four-wheel trailer truck is checked

tive should be trammed for correct distance between the driver-axle centers on both sides. Also, measure the distance from the inside face of the tire to the outside face of the frame ahead of and back of the axle on each wheel. For individual wheels, these distances ahead of and behind the axle should be equal.

This final check indicates that the axles are in proper alignment with the frames, that the wheel centers are in proper alignment with the axles and that the tires are in proper alignment with the wheel centers.

Conclusion

The method of checking the alignment of the main frames, driving wheels, engine and trailer trucks and laying off shoes and wedges, described herein, was developed to meet the requirements of modern locomotive design and present day backshop practice. It is applicable to all types and classes of modern steam locomotives, with slight modifications in certain cases.

The primary base, from which all checking is done, is the *mean* center line of the main frames. The reason for this is that modern heavy frames and bed castings seldom get out of alignment and when they do are difficult to correct, except in the larger shops where ample facilities are available. It is usually easier to compensate for slight cases of misalignment by adjustment of parts other than the frames themselves, such as the thickness of driving-box hub liners, the alignment of cylinder bores, the truing of pedestal jaw faces, etc. Unusual cases of misalignment must, of course, be corrected before permanently satisfactory results can be obtained.

The report was signed by N. M. Trapnell (chairman), assistant superintendent of motive power, C. & O.; J. H. Armstrong, shop superintendent, A. T. & S. F.; A. H. Malenka, shop superintendent, Gr. Nor.; M. D. Chase, shop superintendent, M-K-T; L. D. Richards, superintendent of shops, C. R. I. & P.; R. R. Royal, shop superintendent, I. C., and S. D. Foster, superintendent of locomotive shops, N. Y. C.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Identification of Scale in Boilers

Q.—What are the different types of scale that form in a locomotive boiler? How can they be identified?—M. E. K.

A.—There are three general types of scale; carbonate, sulphate and silicate. The scale is generally composed of more than one of these materials but is classed under the heading of the material which predominates.

Carbonate scale is usually granular and sometimes of a very porous nature. The crystals of calcium carbonate are large but usually are matted together with finely divided particles of other materials so that the scale looks dense and uniform. A carbonate scale can easily be identified by dropping it in an acid solution. Bubbles of carbon dioxide will effervesce from the scale so formed.

Sulphate scale is much harder and denser than a carbonate scale because the crystals of sulphate are smaller and cement together tighter. Sulphate scale is brittle and does not pulverize as easily as the carbonate scale. Also the sulphate scale does not effervesce in acid but will dissolve in hot acid.

Silica scale is the hardest type of scale, resembling porcelain. The crystals of silica are extremely small, forming a very dense and impervious scale. This scale is extremely brittle and very difficult to pulverize. It is not soluble in acid and is usually very light colored.

Maximum Stress Causing Permanent Deformation

Q.—What is meant by the limiting creep stress as applied to boiler steel; should limiting creep strength be included in specifications for flange and firebox steel used in locomotive boilers? —M. K. T.

A.—When steel is subjected to stress it is strained or deformed. If the stress is applied at normal temperature and does not exceed the elastic limit of the steel, the strain is proportional to the applied stress and is taken independent of the time required to apply the stress to the steel. When the stress is removed the steel returns to its original size. At high temperatures it is found that relatively low stresses will result in deformation of the steel that increases with the length of time the stress is applied. This condition has been termed creep and may be defined as the permanent elongation of steel which occurs when the metal is subjected to a stress, the elongation increasing with the length of time the steel is stressed.

The ability of a metal to withstand creep is designated as limiting creep stress. It is usually expressed as the maximum stress which will cause a permanent deformation not exceeding a given amount in a specified number of hours at a definite temperature. It is expressed as the stress which will cause a permanent elongation of not more than one per cent in 10,000 hours at a given temperature, and in the design of some equipment, as one per cent in 100,000 hours at a given temperature.

As a general practice limiting creep strength of steel is only considered for boilers operating at high temperatures and would not be included in the specifications of flange or firebox steel used in locomotive boilers.

Advantages of Cold-Drawn Seamless Boiler Tubes?

Q.—What are the advantages of using cold-drawn seamless-steel tubes over hot-rolled seamless-steel tubes in a locomotive boiler?—F. I. B.

A.—There is no particular advantage in using cold-drawn seamless steel tubes in a locomotive boiler except, perhaps, where weight is involved; with modern power the question of the weight of the locomotive is an important factor in determining what materials are to be used in its construction.

The cold-drawn seamless-steel tubes have a closer dimensional tolerance than the hot rolled tubes and for this reason a more uniform weight can be obtained. Most specifications for boiler tubes provide for a three-gage-plus tolerance for hot-rolled tubes and a two-gage tolerance for cold-drawn tubes. A modern locomotive boiler having 185 3½-in. tubes and 60 2½-in. tubes 19 ft. long would show a difference in weight of approximately 2,000 lb. due to a difference of one gage in the thickness of its tubes.

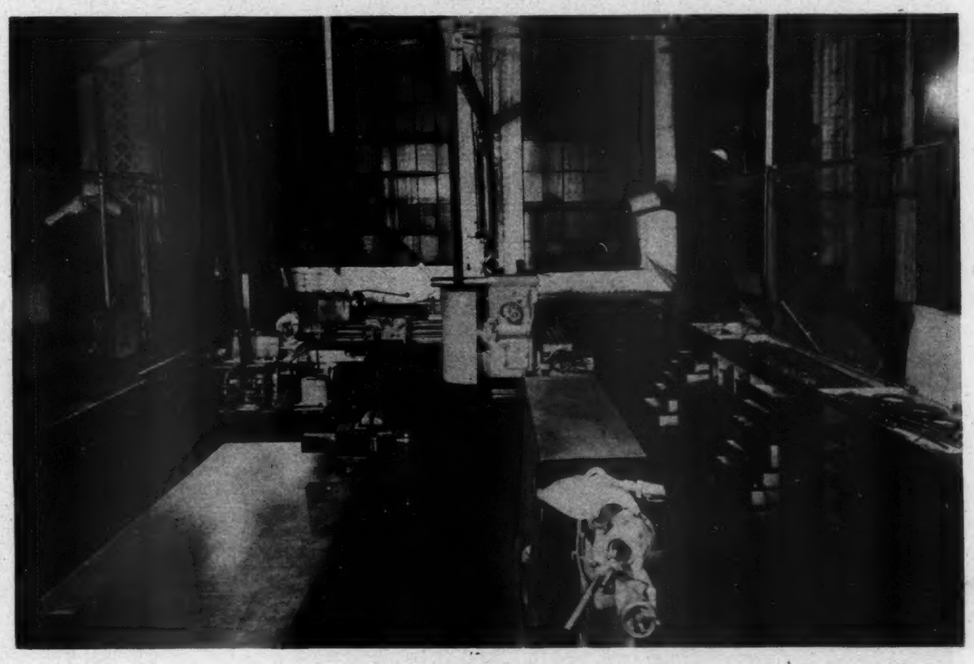
The cold drawing of tubes was adopted primarily to permit the production of smaller diameters, thinner-wall

tubes of great length, better surfaces and closer dimensional tolerances than could be produced by hot processes.

Tool Storage in Metal Cabinets

The accompanying photograph illustrates what may be accomplished in tool storage by the construction of a few well-planned steel cabinets so designed as to take care of all tools in an orderly manner. This rearrangement was recently made in the toolroom at the Nickel Plate Road's locomotive shop at Conneaut, Ohio.

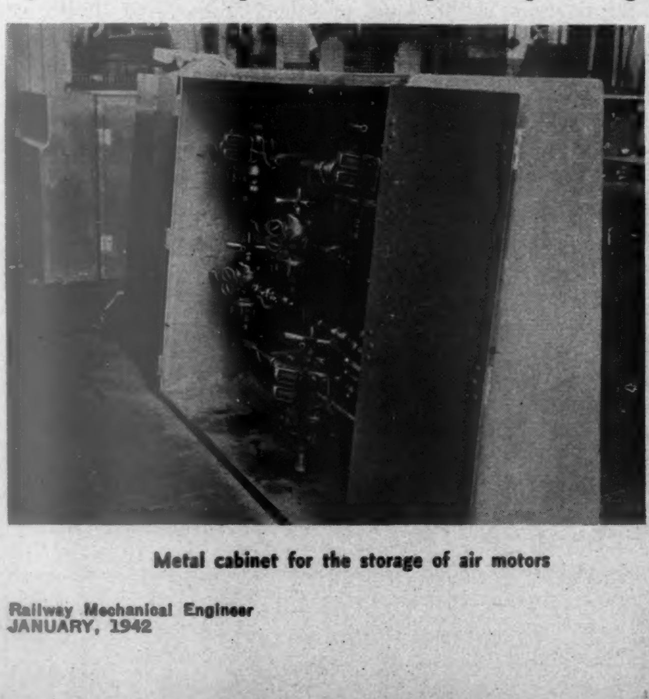
Steel cabinets with polished tops, with conveniently arranged shelves, drawers and compartments have now replaced wooden cupboards and open racks. These cabinets are arranged so that the tops are of uniform height, 43 in. above the floor, and are located around the sides of the toolroom with a pneumatic drill cabinet in the center. The effect not only presents a neat appearance but, by utilizing all available cabinet room and eliminating an estimated 50 per cent waste space, ample storage has been provided with a 25 per cent reduction in floor area.



Steel cabinets with ample drawer space permits tool storage in 25 per cent less floor space

While a similar exterior design has been followed the interior arrangement of these cabinets has been carefully planned to meet every requirement as conveniently as possible. Heavy tools used on the toolroom milling machine are stored in the top compartments, with hinged covers, near the machine and are easily handled with a small crane. In like manner other heavy tools have been made accessible with a minimum of effort.

Milling cutters are kept in a compartment equipped with a ball-bearing cylindrical revolving rack. Smaller tools such as drills, taps, dies, etc., are kept in drawers containing compartments adapted to each particular size and shape. Each drawer and compartment being definitely marked with metal name plates with raised letters denoting its contents so that no difficulty is encountered in selecting tools.



Metal cabinet for the storage of air motors

Questions and Answers On Welding Practices

(The material in this department is for the assistance of those who are interested in, or wish help on problems relating to welding practices as applied to locomotive and car maintenance. The department is open to any person who cares to submit problems for solution. All communications should bear the name and address of the writer, whose identity will not be disclosed when request is made to that effect.)

Removing Bull Ring Rivets Without Burning Your Hands

Q.—What is the best method of removing piston bull ring rivets? I seem to have a great deal of trouble, as the carbon deposit on the head of the rivets and around the bull ring will not permit easy burning and heat from the burning carbon scorches my knuckles.

A.—This operation can be accomplished without discomfort. When the piston is located to suit the operator, place a scrap piece of sheet iron on the floor under the bull ring to keep the slag off the floor. Fix a piercing nozzle in the cutting torch and place an 8-in. square of asbestos paper over the handle of the torch. Arrange

a seat within easy reaching distance of the piston and start cutting on the bottom rivet and work up both ways. The piercing nozzle will remove the carbon and heat the head of the rivet sufficiently to start burning. When the high pressure is applied, the torch is moved first to one side and then the other this will completely remove the head of the rivet. This operation should be completed in a maximum of 10 minutes.

Pipe Manifold For Two Torch Sets

Q.—When repairing units and other work requiring the constant use of both cutting and welding torches, I am in the habit of hooking up two complete outfits. This is often impossible, and it becomes necessary to change the torches each time one or the other is needed. Do you know of a way to avoid this changing of torches?

A.—The material required to do this is a pair of short lengths of ⅜-in. standard pipe. A female hose fitting is

Manifold for connecting welding hose

brazed into a hole in the center of the pipe (the hole can be drilled or burned). On each end a male oxygen hose fitting is brazed; the fittings can be sawed off short to make a neater job. The other short length of pipe is treated in the same manner except that acetylene hose fittings are used.

Two short lengths of acetylene hose and two corresponding lengths of oxygen hose are fitted with the regular connections. The 50-ft. length of hose is fastened to the tanks or shop outlet. The adapters are applied to the end of the 50-ft. hose and the short lengths fastened to the adapters. The cutting torch is connected to one short length and the welding torch to the other, thus making it possible to use both torches from the same outlet.

How to Apply Stellite To Equipment Parts

Q.—I am requested occasionally to apply Stellite to parts of railroad equipment. Will you please explain the proper procedure?

A.—To apply Stellite successfully, the work must be spotlessly clean. By this is meant that the surface to be coated must be bright. A slight feather of acetylene is used, the feather should be about ¾ in. long. The part to be hard surfaced is heated with the carbonizing flame until it begins to turn red. At this point the Stellite rod is placed near the flame and it is heated red. The part and the rod are now heated simultaneously and when the part shows a sweat the red hot rod is melted onto the sweating spot. If the part is in the proper condition the drop will spread like bronze or solder tinning on a bright surface. This procedure is carried out until the entire surface to be coated is covered. Increasing the thickness of the deposit is similar to any steel welding. If both sides of the object are to be hard surfaced, the oxide resulting from heating the first side will have to be removed before the second side can be hard surfaced.

Welded Bends in Pipes of Large Diameter

Q.—We are desirous of fabricating large booster and feedwater heater piping by welding in order to eliminate the large radii necessary to bend these pipes. We would appreciate your recommendations as to the proper method of making welded bends in pipes of 3-, 3½-, 4- and 4½-in. diameter.

A.—In welding pipe bends in pipes of these diameters, the edges of the pipes at the joint to be welded should be bevelled to give a vee of from 60 to 70 deg. wherever possible. The pipes should be gapped at the joint from 1/16 in. to ⅛ in. and the joint should be tack welded at intervals around the pipe so that when welding, the space between the pipes will not contract and close. The tack welds should be made at sufficient intervals so the gap in the joint is not less than 1/16 in. at any time during the welding.

When the welding metal used has the same tensile strength as the metal in the pipe, a minimum of 10 per cent reinforcement of the weld is necessary. When the weld metal has a lower tensile strength than that of the pipe, sufficient reinforcement of the weld is necessary to insure a joint as strong as the pipe. A 25 per cent reinforcement is the usual practice. Figs. 1 to 4 illustrate typical welded joints for various angles used in fabricating welded bends.

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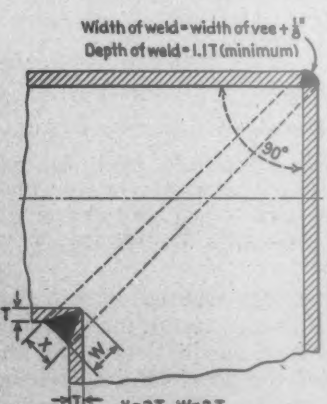


Fig. 1

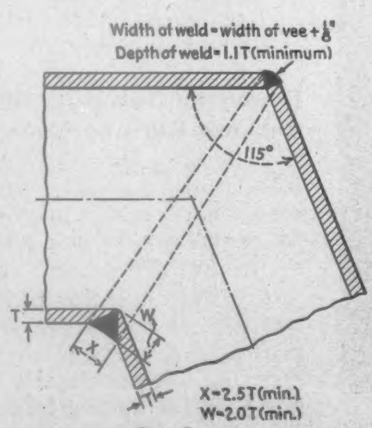


Fig. 2

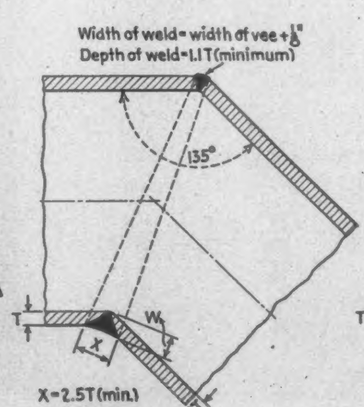


Fig. 3

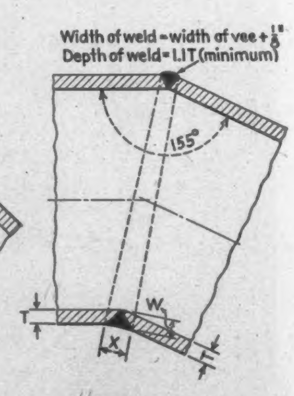
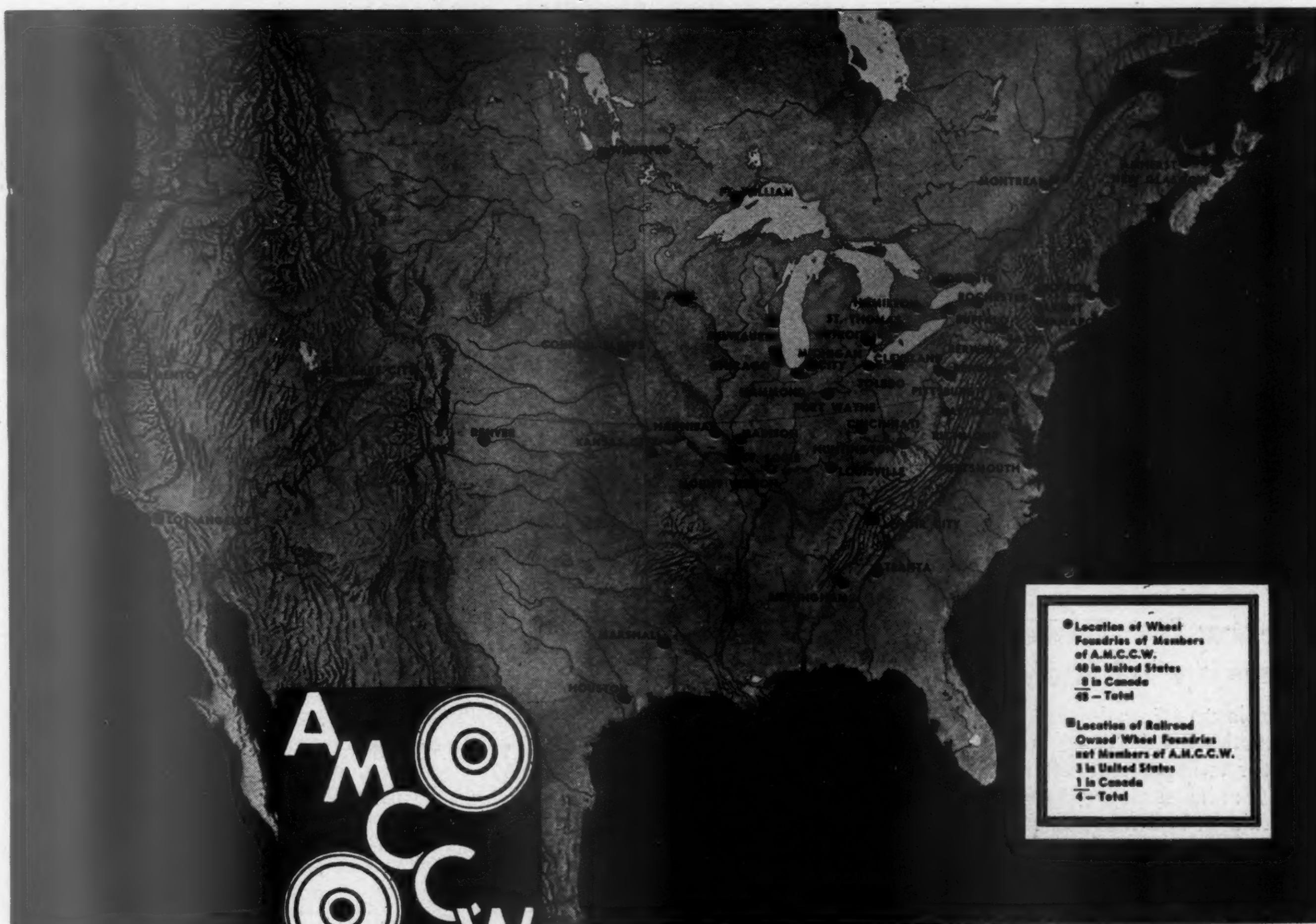


Fig. 4



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Hannibal Car Wheel & Foundry Company
Louisville Car Wheel & Railway Supply Company
Marshall Car Wheel & Foundry Company
Maryland Car Wheel Company
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Repairing Worn Spot in High-Pressure Steam Line

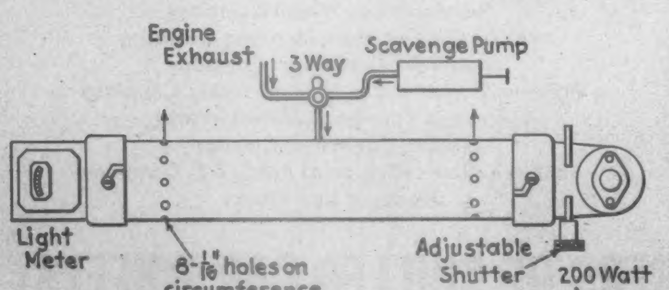
Q.—Several times in the past, I have been called upon to weld tiny holes in the bottom of the high-pressure steam line. These holes are spots worn or rusted thin. When I attempted to weld them with the torch, the flame burned a hole through the thin metal and before I can close it, the opening is sometimes two or three inches long. This makes a difficult welding job. Is there an easier way?

A.—When a pipe line begins to develop leaks due to rusting and pitting on the inside it is a good plan to remove the entire section of pipe. However, if an emergency repair must be made, sound the worn section with a peen hammer to find the area of the worn section—usually it is about 3 in. Make a narrow patch of ⅛-in. plate, bend it to fit the radius of the pipe and tack it in place over the leak in the pipe. Heat the patch and lay it up tight to the pipe. Weld all around with the torch and steel rod. In this manner, burning through the pipe is avoided, making a neat emergency repair.

Meter for Determining Density of Exhaust Smoke

There is no more dependable indicator of the quality of combustion in a Diesel engine than the exhaust smoke. A clear exhaust is evidence of clean combustion, while a dark exhaust is proof of imperfect combustion. When the exhaust is smoky, high fuel consumption and troubles from soot deposits can be predicted with practical certainty. However, exhaust observations are usually made with the free eye, which gives inaccurate results during day time and practically none at night. The exhaust smoke can be judged best with a background of blue sky, but even then the quantity of the exhaust, the observation distance, and the personal element prevent a strict comparison of the observations. On a cloudy day, or in the absence of the sky background, visual observations are less trustworthy, and at night impracticable.

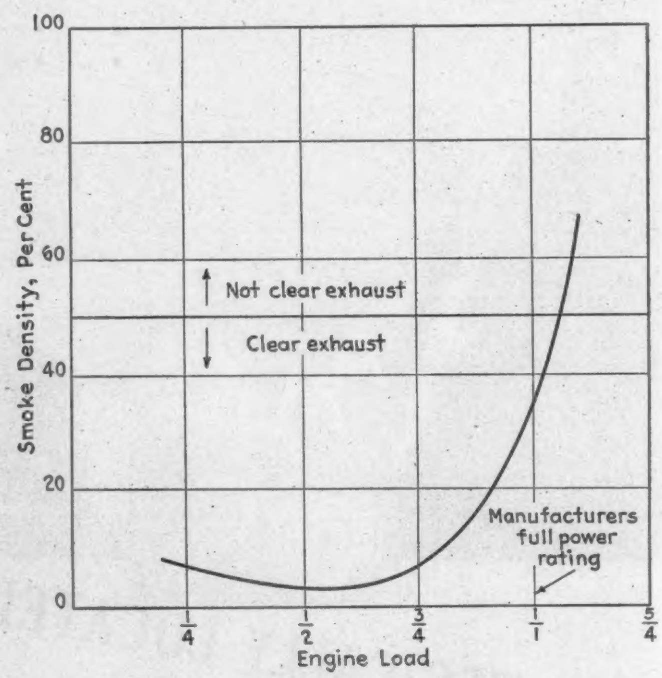
A simple smoke meter has been developed in the Diesel laboratory of Pennsylvania State College and used there as well as by numerous other laboratories with satisfactory results. It consists of a tube about 1¾ in. inside diameter, and 18 in. long, with a glass window at each end. A 200-watt projection lamp is mounted on one end and a shutter with an adjustable diaphragm is interposed between the lamp and the window. A rheostat instead of the shutter may be used to regulate the light intensity by changing the voltage. On the other end of the tube a General Electric pocket-type light meter of the type generally used for measuring room illumination, is mounted.



Exterior and sectional views of the smoke meter

The exhaust is led to the center of the smoke meter tube through a ¼ in. inside diameter copper tubing. The smoke meter tube is open to the atmosphere through two rows of 1/16 in. holes on both ends, 2 in. from the windows. It is advisable to hinge both windows, or make them easily demountable, to facilitate cleaning.

The smoke density is measured in the following way: The tube is scavenged with air, and the light meter hand is brought to register 50-ft. candles by adjusting the shutter (or rheostat). Then the smoke meter is connected to the engine exhaust, and when the hand assumes its new equilibrium in about 30 sec., the foot-candle reading is recorded. If the reading is, say 30 foot-candles, the loss in light intensity is 20/50 = 40 per cent, and the corresponding smoke density is denoted 40. If the instrument registers no loss in light intensity when switching from free air to engine exhaust, then the smoke density is, of course, zero.



Typical engine smoke-density record

Besides its simplicity there are other points in its favor. The results are independent of the light source intensity, light meter sensitivity, deposits on the windows, exhaust-gas velocity, cross-sectional area of the smoke meter tube and the point of location for the connecting tube on the exhaust manifold. The only factor that enters—besides the smoke density—is the length of the tube, which can be conveniently standardized at 18 in. If the windows become obscured during the test, or the light source changes in intensity, etc., the effect is neutralized by so adjusting the shutter that the light meter hand registers 50 with free air. If the exhaust smoke causes the hand to go back to x then the smoke density is 100 (1—x/50) per cent.

The accompanying chart shows a typical smoke-density record of an engine. It will be noted that between ¼ and ¾ load the smoke density is practically zero. Beyond the ¾-load point the smoke density increases slowly, while beyond the normal full load it increases rapidly. Against blue sky background the smoke is just beginning to be clearly visible when the smoke meter registers a smoke density of 50.

High Spots in

Railway Affairs . . .

Mexican Railroads Making Headway

The National Railways of Mexico experimented for two years under the Workers' Administration. Things went from bad to worse; expenses got out of control; employee morale declined, and serious accidents took place because of the lack of discipline. Finally, a year ago, the Workers' Administration of the Railways was abolished by a decree of President Camacho, and on January 7, 1941, a law was made effective by which the government assumed responsibility for the operation of the railways. A new management was placed in charge. Firmly, but without disturbance, discipline was restored and a drastic control of expenditures was inaugurated. The effect of these measures was reflected in the 1941 operations and promises to be still more pronounced in 1942. General Estrada, the general manager, reported to the Senate early last year that during the Workers' Administration an "unbalanced generosity" had existed in the recognition of labor demands and in granting privileges and concessions beyond the financial power of the railroads. His objective was to operate them on a strictly commercial and sound economic basis, attempting to keep the expenses well within the limit of 85 per cent of the earnings, and holding the payroll down to not more than 48 per cent of the total expenses.

Rate Increase Hearings

The granting of the wage increases to railroad employees makes necessary a readjustment of freight and passenger rates. The necessity for this was recognized by the emergency board which functioned under the provisions of the Railway Labor Act. The railroads on December 13 filed a petition seeking an increase of 10 per cent in all passenger fares, except in the 1¼ cents per mile rate allowed members of the military or naval forces traveling on furlough. No increase was requested in the extra fares charged on extra fare trains. An increase of 10 per cent was requested for all freight rates, except for anthracite and bituminous coal, coke and iron ore, for which special adjustments were requested. The new rates should be established as promptly as possible; to this end the Interstate Commerce Commission started to hold hearings at St. Louis, Mo., on January 5. Oral arguments before the entire Commission will follow immediately after the hearings are completed. The Railway Express Agency hearings will begin on January 9 and will follow through along with the railroad case. It is a most unusual circumstance for the entire Commission to sit on a hearing outside of Washington. It is anticipated that the hearings will be completed within a week or two.

Retirement Board Moving to Chicago

Washington, badly overcrowded by the national defense activities, must still further increase the federal personnel with our entry into the World War. Some headway could be made in eliminating congestion if non-essential, non-defense activities and bureaus were cut down and dispensed with. Congress and the Administration, however, seem unwilling to take such a common-sense and practical step. Patronage and the pork barrel still prevail, in spite of the desperate straits into which the taxpayer is being forced. To make room for the increased war activities, 12 federal bureaus have been ordered out of Washington by President Roosevelt. Among the "first batch" to go is the Railroad Retirement Board, with its 1,600 employees. The board has been handicapped by the fact that its 222,000 sq. ft. of office space in Washington has been scattered among eight buildings. It had looked forward to the time when its work would be consolidated in the so-called Railroad Retirement Board Building. That, however, was taken over by defense agencies and the Retirement Board has no space in it. Chairman Latimer is trying to arrange for office space in Chicago, to which place the work of the bureau is to be transferred.

Director of Transportation

Even under normal conditions there has been a growing recognition in this country of the advisability of co-ordinating the various forms of transportation in such a way as to insure adequate transportation to all of our people and at the lowest possible unit cost. True, we have not made much progress in that respect, and yet there has been a steady trend in the right direction. It is vital in a national emergency, such as the one that now confronts us, that all of the common carriers work intelligently and closely, to the end that the transmission of necessary freight and passenger traffic be facilitated as much as possible and without needless waste of effort or energy. President Roosevelt has appointed Joseph B. Eastman, chairman of the Interstate Commerce Commission and former federal co-ordinator of transportation, to the newly created position of Director of Defense Transportation. Apparently Mr. Eastman will become, in effect at least, a member of the President's Cabinet, and as a representative of the Commander-in-Chief, will take such steps as may be necessary "to assure maximum utilization of the domestic transportation facilities of the nation for the successful prosecution of the war."

Mr. Eastman And the Railroads

The railroads made a splendid record last year, in spite of the heavy movement of traffic caused by the World War and our national defense program. There is no indication that they will not be able to meet the demands that may be made upon them during this year and next year, if they are permitted to add a reasonable number of new cars and locomotives and secure material for the necessary repairs. The appointment of Mr. Eastman as Director of Defense Transportation, therefore, bears no relationship to the breakdown of the railroads during the first World War and the appointment of a Director General of the Railroads. In other words, the government is not taking over the operation of the railroads; moreover, Mr. Eastman's jurisdiction extends over all forms of transportation and is not restricted to the railroads. In a broad way, there are many things that he can do under emergency provisions which will permit, if advisable, a closer co-ordination of all of our present methods of transportation. Likewise, there are possibilities in a closer co-ordination of the transportation policies and activities of the various government departments. Undoubtedly, also, Mr. Eastman will be able to speak with a certain tone of authority in dealing with those who have charge of material priorities and in seeing that the needs of the railroads, as well as the other types of transportation are provided for. It is quite possible that as a representative of the government he may find it necessary to make recommendations for certain changes in the rates. These may have to take the usual course through the Interstate Commerce Commission, but undoubtedly corners can be cut and prompt action taken if he so recommends. Mr. Eastman's familiarity with transportation problems, because of his long experience on the Interstate Commerce Commission and also his experience as Federal Co-Ordinator of Transportation, fit him admirably for the task which has been assigned to him. He is assured of full support and co-operation on the part of the railroads.

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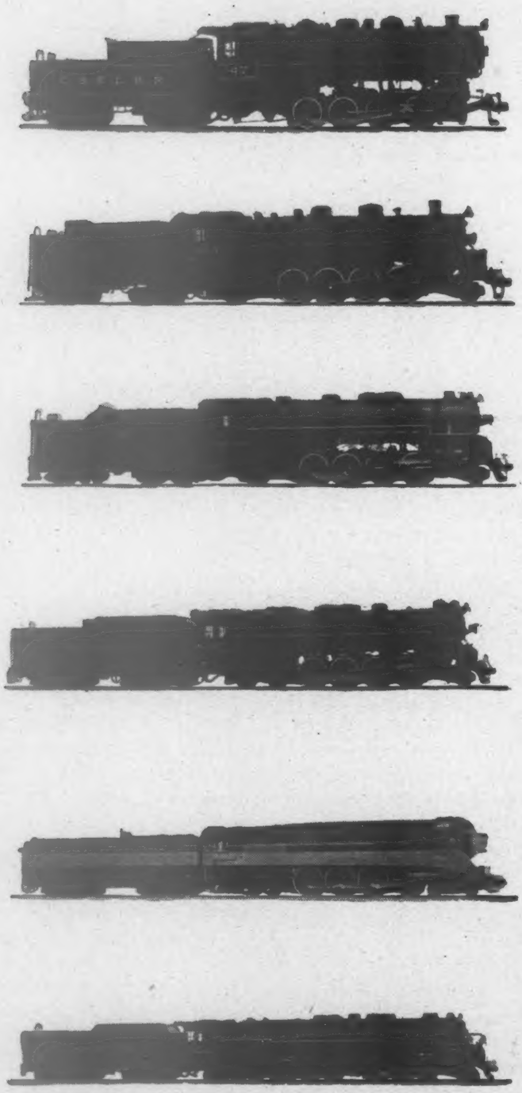
FROM SWITCHER



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Among the Clubs and Associations

Railway Club of Pittsburgh.—Meeting held December 18, Pittsburgh, Pa. Speaker: John W. Barriger, III, Western Carriers' Conference Committee. Subject: The Railroad Futurama.

New England Railroad Club.—Meeting January 13, Hotel Touraine, Boston, Mass. Dinner, 6:30 p. m. Speaker: Prof. Kent T. Healy, Yale University. Subject: Railroad Policy of the Present Emergency.

Northwest Locomotive Association.—Meeting held December 15, St. Paul, Minn. Speaker: L. E. Caldwell, Service Educational Director. Subject: Modern Diesel Locomotives. Motion pictures, "Electro-Motive Railway Type Diesel Engines."

Railway Club of Pittsburgh.—Meeting January 15, 8 p. m., Fort Pitt Hotel, Pittsburgh, Pa. Dinner at 6:30 p. m. Speaker: Professor Louis E. Endsley, consulting engineer, Pittsburgh. Subject: The Diesel Electric Locomotive.

Car Department Association of St. Louis.—Meeting January 20, 8 p. m., Hotel DeSoto, St. Louis, Mo. Dinner and social period 6 p. m. Speaker: W. Carl Ketcherside. Subject: Safety—First, Last and Always. Oil firing film of Shell Oil Company.

Eastern Car Foreman's Association.—Meeting held January 9. Speaker: P. J. Hogan, superintendent car inspection and maintenance, New York, New Haven & Hartford. Subject: A. A. R. Rules of Interchange.

Car Foreman's Association of Chicago.—Meeting 8 p. m., January 12, La Salle Hotel, Chicago. Speaker: J. E. Mehan, assistant to superintendent car department, Chicago, Milwaukee, St. Paul & Pacific. Subject: A. A. R. Rules of Interchange.

Northwest Car Men's Association.—Meeting held January 5. Speaker: J. E. Mehan, assistant to superintendent car department, Chicago, Milwaukee, St. Paul & Pacific. Subject: A. A. R. Rules of Interchange.

Car Foremen's Association of Omaha, Council Bluffs, and South Omaha Interchange.—Meeting January 27, 8 p. m., Castle Hotel, Omaha, Neb. Speakers: F. E. Cheshire, president, and G. R. Anderson, vice-president, Car Department Officers Association. Subject: Changes in A. A. R. Rules and Problems of Transportation in War.

St. Louis Car Men Hold Live Annual Meeting

At the annual meeting of the Car Department Association of St. Louis, held Tuesday evening, December 16, at the Hotel DeSoto, St. Louis, Mo., the following were elected officers for the ensuing year: President, A. R. Holloway, passenger car foreman, Pennsylvania, St. Louis, Mo.; first vice-president, G. R. Phillips, superintendent, St. Louis & O'Fallon, East St. Louis, Mo.; second vice-president, L. W. Martin, general car foreman, Terminal Railroad Association of St. Louis; third vice-president, R. G. Setzekorn, mechanical superintendent, American Refrigerator Transit Company, St. Louis. J. J. Sheehan, chief clerk to superintendent car department, Missouri Pacific, was reelected secretary, and J. J. Helle, chief clerk to superintendent, St. Louis Refrigerator Car Company, was re-elected treasurer. ¶President H. C. Argast, superintendent, St. Louis Refrigerator Company, presided at the meeting and after the election of officers introduced E. L. Woodward, western editor, *Railway Mechanical Engineer,* who served as chairman of the Award Committee, and announced the following award of prizes for seven short papers presented at regular monthly meetings throughout the year by car men from the ranks: Twenty-five dollar first prize for the paper "Passenger Car and Coach Yard Sanitation," presented at the September 16 meeting by Neal J. Capaldo, clerk and extra gang foreman, Terminal Railroad; $15 second prize for the paper "Pullman Equipment Maintenance and Periodic Inspection," presented at the March 18 meeting, by W. T. Kidwell, yard foreman, Pullman Company; $10 third prize for the paper "Fire Prevention in Connection with Car Department Work," presented at the February 18 meeting by Edward Sparn, planing mill man, Southern; and $2 each for the following: "The Past and Present-Day Tank Car," presented at the April 15 meeting by C. H. Behen, Socony, Vacuum Oil Company; "The Progress of American Railroads During the Past Ten Years," presented at the January 21 meeting by E. C. Bailey, car man helper, Pennsylvania; "Air-Conditioning Equipment on Passenger Cars," presented at the October 21 meeting, by W. J. Parrott, electrician, Missouri Pacific; "Opportunities Afforded Apprentices in the Car Department," presented at the May 20 meeting, by A. H. Zack, leadman, Illinois Central. ¶Other members of the Award Committee who worked with the chairman in rating the individual short papers included D. J. Sheehan, superintendent motive power, Chicago & Eastern Illinois, and R. G. Setzekorn, American Refrigerator Transit Company, St. Louis. As soon as the award was announced, the Entertainment Committee, under the direction of C. B. Martin, St. Louis Malleable Castings Company, took charge of the meeting and put on an interesting program of entertainment for approximately 400 members and guests who were in attendance.

V. R. Hawthorne Addresses Chicago Car Foremen

At a meeting attended by 500 members and guests on Monday evening, December 8, at the Hotel LaSalle, Chicago, the Car Foremen's Association of Chicago was addressed by V. R. Hawthorne, executive vice-chairman, Association of American Railroads, Mechanical division, on the subject "Keep the Wheels Rolling." Included among those attending were several officers and members of the National Car Department Officers' Association and also a group of 17 representative St. Louis car men, members of the Car Department Association of St. Louis. ¶Mr. Hawthorne emphasized particularly the necessity of greater care in the securing of lading, the prompt and expeditious handling of bad order cars to the repair tracks and avoidance of the shopping of all loaded cars which can be handled safely to destination. In closing his remarks, Mr. Hawthorne said that "the railroads, during the coming months, will be expected to accept and transport the greatest volume of traffic in their history. The size of the railroad plant, roadway, shops, locomotives and cars, will, to a great extent, be limited to what we already have. We should not, however, get the idea that the railroads are operating to capacity. No one knows what the capacity of the railroads is. It depends upon how well the officers and employees do their job. It is, therefore, the obligation of every railroad man to do everything in his power to obtain the utmost utilization of the facilities and equipment now available or which may be acquired in the future. It is up to all railroad men, including you car men, to do the best job possible in order that the business offered may be handled with safety and dispatch. It is up to all of us to 'Keep the Wheels Rolling.'"

NEWS

Pelley Cites 1941 Service Records

"RAILROADS of the United States in 1941 handled, without congestion or car shortage, the greatest volume of freight in their history, and they are confident of their ability to meet transportation demands in 1942 if materials for adequate maintenance and for new construction are made available," said J. J. Pelley, president of the Association of American Railroads in a year-end statement issued December 30.

A part of Mr. Pelley's statement follows:

"Despite unprecedented conditions, and the quickening effect of a growing defense and war production, traffic this year has moved smoothly and without delay. The railroads have performed an operating job of which they can well be proud. Measured in revenue ton-miles, the freight volume transported in 1941 amounted to approximately 470 billion ton-miles. This was an increase of 5.1 per cent above the previous record made in 1929. It also was an increase of 25.9 per cent above 1940. This record traffic took place despite the fact that carloadings of revenue freight were 20 per cent less than in 1929 and was due to a combination of heavier loading per car and longer haul per ton than in previous years. In 1941, freight loadings totaled 42,250,000 cars, an increase of 5,892,000 cars or 16.2 per cent above 1940.

"This volume of freight traffic was handled, however, with an ownership of nearly 600,000 fewer cars, or 26 per cent, than in 1929. It was accomplished because of a continuous improvement in cars, locomotives, and facilities, and in operating methods and efficiency, that started 20 years ago and has kept growing despite the ups and downs of the railroads in more recent years. The result has been that the railroads in 1941 hauled more freight per train than ever before and moved each train over the road nearly 1½ times as fast compared with 20 years ago.

"Although the railroads have handled this year more freight traffic and almost as great a passenger traffic as in 1929, they received for that service nearly a billion dollars less in gross earnings. This has been due to the fact that both freight and passenger rates are now much lower than they were twelve years ago.

"Among the outstanding efficiency records established by the railroads in the past year were the following, based on returns for the first ten months:

"1. Average load of freight per train was 915 tons, a new all-time high and an increase of 40.6 per cent above that for 1921.

"2. Performance per train hour more than doubled, gross ton-miles per freight train hour having increased from 16,555 in 1921 to 34,814 in 1941, while net ton-miles per freight train hour increased from 7,506 in 1921 to 14,977 in 1941.

"3. For each pound of fuel used in freight service in 1941, railroads hauled 9.2 tons of freight and equipment one mile compared with 6.2 tons in 1921.

"4. Average daily movement of locomotives was greater in 1941 than in any preceding year.

"5. Average daily movement of freight cars established a new high record and exceeded 20 years ago by 45 per cent.

"6. Capacity per freight car averaged 50.4 tons, the greatest ever attained and an increase of 18.6 per cent compared with 1921.

"7. Tractive force of locomotives averaged 51,495 lbs., an increase of 39.4 per cent compared with twenty years ago.

"Passenger traffic in 1941 was greater than in any year since 1929, it having amounted to 29 billion passenger miles, an increase of 22.1 per cent above 1940. This increase above last year was due in part to troop movements, the railroads having handled approximately three million troops during the year. The average revenue for carrying a passenger one mile during the past year was the lowest on record, amounting to 1.75 cents compared with 3.09 cents in 1921.

"Railroads in 1941 installed about 80,000 new freight cars and about 600 new locomotives in service. They will enter the new year with approximately 75,000 new freight cars and 600 new locomotives on order with deliveries being constantly made. At the same time, both the number and percentage of freight cars now in need of repairs are less than ever before.

"In order to furnish defense officials with information as to the extent to which car and locomotive building plants will be required to take care of the railroads' needs in the coming year, the rail lines, through the Association of American Railroads, in December resurveyed their equipment needs for the coming year. As a result it has been determined that orders will be placed for the construction, in the year extending from October 1, 1941 to October 1, 1942, including those on order on the previous date 115,000 new freight cars and 974 new locomotives, including steam, electric and Diesel-electric. In the opinion of railroad executives after a careful study of the general situation and railway performance in the past, this will increase their available motive power and car supply sufficiently to enable the rail lines to handle at least a 10 per cent increase in traffic compared with 1941.

"Stimulation in traffic during the past year has improved somewhat the financial position of the railroads. Whether this will continue to be true in the coming years remains uncertain owing to rising costs of operation resulting in part from the recent mediation award by which employees were given an increase in wage rates, together with vacations with pay to certain classes of employees, at a total cost to the railroads of about $331,771,000 annually. The railroads have asked the Interstate Commerce Commission for authority to increase freight and passenger rates. Hearings in the matter are scheduled to begin on January 5, 1942.

"While complete reports are not yet available, Class I railroads in 1941 are expected to have a net railway operating income before fixed charges of approximately $980,000,000, or a return of 3.72 per cent on their property investment. For the first time since 1930, a period of 11

(*Continued on second left-hand page*)

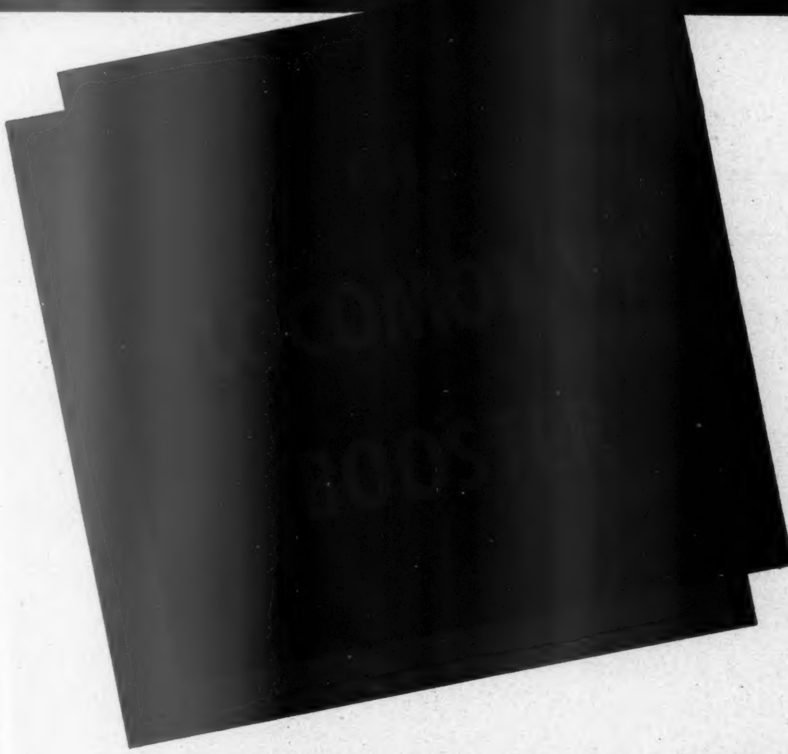
* * *

Paul's Photos

Narrow-gage locomotive, built by Baldwin in 1890, making its last trip over a branch line (now abandoned) of the Colorado & Southern

e for '42...

"EXTRA CAPACITY" DEVICES



For capacity

TO START AND ACCELERATE HEAVY LOADS

With the increasing demand for moving heavy loads at high speeds, the problem of starting and accelerating the heavier loads becomes increasingly acute. The new type "E" Booster will effectively solve this problem. The added starting tractive effort that it makes available can be utilized up to a speed of 35 M.P.H. and it can be cut in at a speed of 22 M.P.H. The added tractive effort of Booster Power gives your locomotives the "extra" power needed to start today's heavier loads rolling. As speed drops on a grade the engineer can cut-in the Booster and gain added tractive effort until the locomotive reaches normal running speed again.

Install Locomotive Boosters on new or old power and get the added starting effort so necessary in meeting today's time schedules.

LY COMPANY, INC.

NEW YORK
CHICAGO
MONTREAL

years, this rate of return exceeded three per cent. During the ten intervening years, 1931 to 1940, the rate ranged from a low of 1.24 per cent in 1932 to a high of 2.59 per cent in 1940. In 1940, their net railway operating income was $682,000,000. After fixed charges, the Class I railroads, according to preliminary estimates, will have a net income in 1941 of $485,000,000, compared with $189,000,000 in 1940. Gross revenues in 1941 approximated $5,325,000,000, an increase of 23.9 per cent above 1940, but a decrease of 15.2 per cent below 1929. Operating expenses were approximately $3,660,000,000 in 1941, an increase of 18.5 per cent above the preceding year but a decrease of 18.8 per cent below the 1929 figure.

"Taxes in 1941 were the highest for any year on record, amounting to $550,000,000 or a daily average of $1,507,000. The previous record for taxes was in 1929, when they amounted to $396,700,000. Maintenance expenditures of Class I railroads in 1941 totaled $1,590,000,000 compared with $1,316,000,000 in 1940. Of the total in 1941, expenditures for maintenance of equipment amounted to $990,000,000."

Copper in Locomotives and Cars To Be Eliminated

At least 30 per cent of the copper used in locomotives and cars can be eliminated, according to reports made by manufacturers to a Special Committee on Locomotive and Car Construction of the Mechanical Division of the Association of American Railroads at Chicago on December 29. The meeting followed a similar one on December 16 at which substitutes for copper and for copper-alloy parts in locomotives and cars were discussed as the result of Conservation order No. M-9-c issued by the Priorities division of the OPM.

The Special Committee of the Mechanical Division will consolidate the reports of the manufacturers and submit the consolidation and its own recommendations to the OPM. It is expected that the OPM will later issue specific instructions as to the use of copper in locomotives and cars.

Steel Priorities Extended to December 31, 1942

General preference orders affecting pig iron, steel, steel warehouses, and special kinds of iron and steel have been extended to December 31, 1942, by the Acting Director of Priorities. All of these had been scheduled to expire November 30, 1941.

Most important of these orders, it is pointed out, is General Preference Order M-21, which puts steel under priority control. General Preference Orders M-17, M-21-a and M-21-b, which are also extended, cover pig iron, alloy steels, and steel warehouses. The orders also apply to inventories of any of these materials.

Another order also extended is Preference Rating Order No. P-31, which assigns limited blanket ratings of A-1-b and A-1-c to orders for certain materials essential to the operations of manufacturers of foundry equipment and repair parts. This order was extended to May 30, 1942.

Complete Allocation of Steel Plates

Complete allocation of steel plates was ordered on December 1 by Donald M. Nelson, director of priorities, Office of Production Management, in General Allocation Order No. 1. The action is the first step in compliance with the request of the Supply, Priorities and Allocations Board, made November 1, that a direct allocation system for steel be worked out.

Defense demands for steel plates are such that the Army, Navy and Maritime Commission take approximately 50 per cent of existing capacity. Other "leading users" listed in the OPM announcement are the railroads, for car construction, and the petroleum industry, for pipe and in the construction of all types of tanks.

As of November 1, reports from steel plate producers showed defense and essential civilian orders, with ratings of A-10 or higher, in excess of production capacity for shipment during the month. Capacity of the industry is about 600,000 tons a month. The order effective December 1, 1941, defines plates and provides that no person shall produce, deliver or accept plates except in accordance with the orders issued by the director of priorities.

Producers are required to file with OPM's Iron and Steel Branch, by the 15th of each month a schedule of production and shipments for the following month, together with a statement of unfilled orders for the period. They then will receive an allocation order from the director of priorities, making any changes that are deemed advisable. Plates produced in excess of schedule cannot be disposed of except at the direction of the director of priorities.

The order also provides that suitable forms for producers and customers will be prescribed from time to time. Immediate purpose of the order, according to OPM, is to insure "a continuous flow of plates into defense channels and to provide an adequate check against hoarding and excessive inventories."

Studies of steel plate requirements for non-defense industries now are being made by the Division of Civilian Supply in conjunction with the Division of Materials to determine what proportion of the available supply should be allocated to each. No direct allocations of this kind have yet been made, although substantial steps in this direction are being taken. Steel has been

(Continued on next left-hand page)

Orders and Inquiries for New Equipment Placed Since the Closing of the December Issue

Locomotive Orders

Road	No. of Locos.	Type of Locos.	Builder
Akron & Barberton Belt	1	660-hp. Diesel-elec.	Baldwin Loco. Wks.
Akron, Canton & Youngstown	1	1,000-hp. Diesel-elec.	American Loco. Co.
Alton	1	4,000-hp. Diesel-elec.	Electro-Motive Corp.
Belt Railway of Chicago	2	1,000-hp. Diesel-elec.	American Loco. Co.
	2	1,000-hp. Diesel-elec.	Electro-Motive Corp.
Bessemer & Lake Erie	2	2-10-4	Baldwin Loco. Wks.
	2	0-8-0	American Loco. Co.
Bingham & Garfield	1	1,500-hp. Diesel-elec.	General Electric Co.
	1	1,000-hp. Diesel-elec.	American Loco. Co.
Brecon Loading Corp.	1	Diesel-elec.	General Electric Co.
Canadian Pacific	17	4-6-2	Canadian Loco. Co.
Carnegie-Illinois Steel Corp.	4	400-hp. Diesel-elec.	General Electric Co.
Chicago & North Western	8	1,000-hp. Diesel-elec.	American Loco. Co.
	12	660-hp. Diesel-elec.	Electro-Motive Corp.
Chicago, Indianapolis & Louisville	3	1,000-hp. Diesel-elec.	Electro-Motive Corp.
	1	600-hp. Desel-elec.	
F. C. Del Estado Villazon-Atocha (Bolivia)	4	2-10-2	Baldwin Loco. Wks.
Iran Government	24	190-hp. Diesel-mech.	Davenport Besler Corp.
Kansas City Terminal	4	660-hp. Diesel-elec.	American Loco. Co.
National Rwys. of Mexico	11	4-8-4	Baldwin Loco. Wks.
	6	2-8-0	
	9	4-8-4	American Loco. Wks .
	7	2-6-6-2	
New Orleans & Northeastern	4	2,700-hp. Diesel-elec.	Electro-Motive Corp.
New York, Chicago & St. Louis	6	Diesel-elec.	American Loco. Co.
	4	Diesel-elec.	Electro-Motive Corp.
Northeast Oklahoma	1	500-hp. Diesel elec.	General Electric Co.
Northern Pacific	2	1,000-hp. Diesel elec.	American Loco. Co.
Ravenna Ordnance Plant	2	Diesel-elec.	General Electric Co.
Tennessee Central	1	660-hp. Diesel-elec.	American Loco. Co.
Tennessee Coal, Iron & R. R. Co.	4	660-hp. Diesel-elec.	American Loco. Co.
Terminal R. R. Association of St. Louis	2	1,000-hp. Diesel-elec.	Electro-Motive Corp.
	2	1,000-hp. Diesel-elec.	American Loco. Co.
	1	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
U. S. Navy Dept., Bureau of Supplies and Accounts	5	Diesel-elec.	General Electric Co.
	2	Diesel-elec.	H. K. Porter Co.
	1	Diesel-elec.	Whitcomb Loco. Co.
	1	Diesel-elec.	Fate-Post-Heath Co.
U. S. War Dept.	70[1]	2-8-2	Lima Loco. Wks.
	70[1]	2-8-2	Baldwin Loco. Wks.
	60[1]	2-8-2	American Loco. Co.
	1	Diesel-elec.	H. K. Porter Co.
	1	Diesel-elec.	General Electric Co.
		....	Vulcan Iron Works[2]

Locomotive Inquiries

Road	No. of Locos.	Type of Locos.	Builder
U. S. Navy Dept.	1	45-ton Diesel-elec.	....
	1	50-ton Diesel-elec.	....
	1-2	35-ton Diesel-elec.	....
Wabash	3	Diesel-elec.	....

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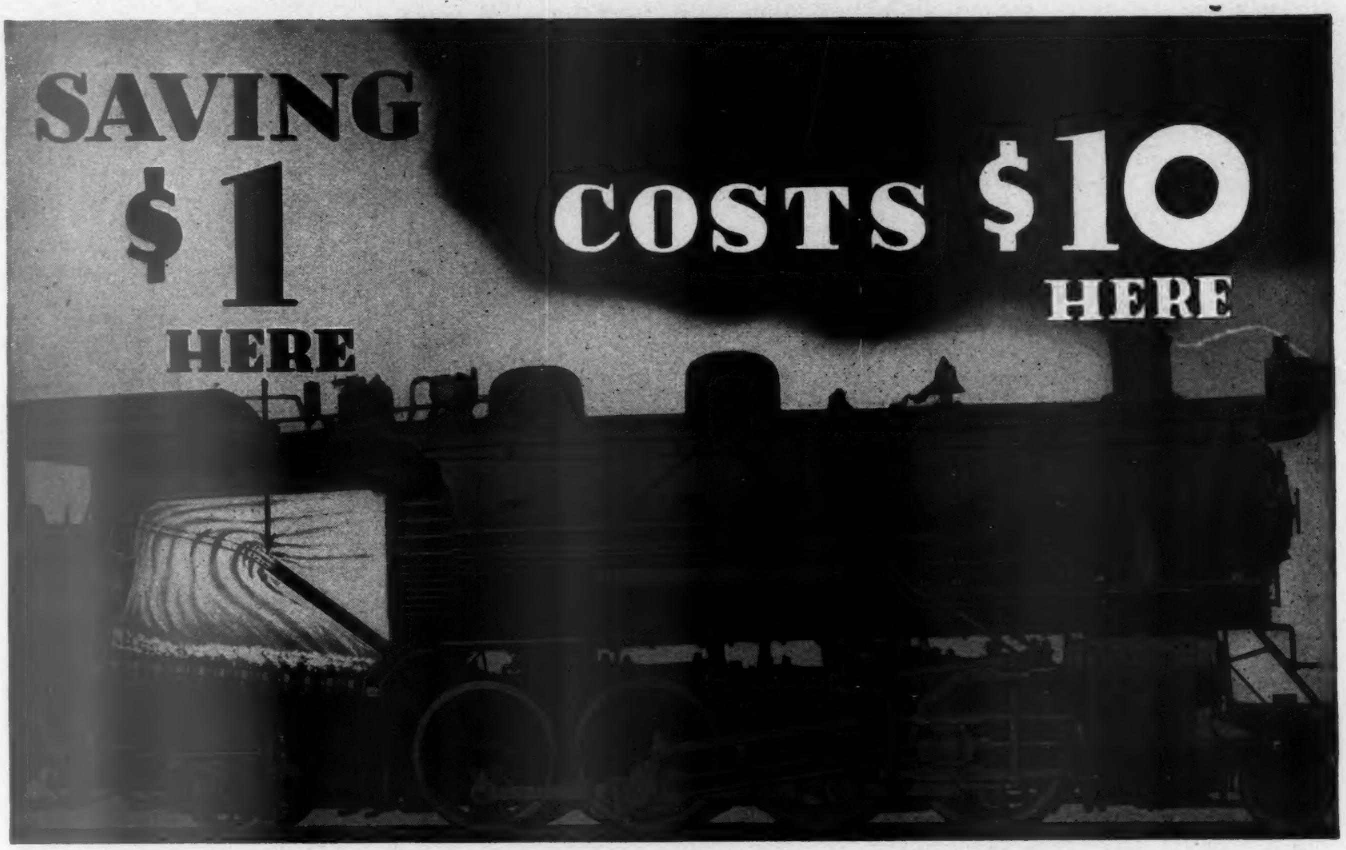
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Freight-Car Orders

Road	No. of Cars	Type of Cars	Builder
Aliquippa & Southern	50[2]	100-ton gondola	Company shops
Aluminum Co. of America	3	40-ton refrigerator	Company shops
Burlington Refrigerator Express Co.	300[3]	70-ton hopper	Gen. Amer. Transp. Corp.
Birmingham Southern	10	90-ton transfer	American Car & Fdry. Co.
Chicago & North Western	250	70-ton ore	Bethlehem Steel Co.
Chicago, Indianapolis & Louisville	10	70-ton hopper-cement	Gen. Amer. Transp. Corp.
Elgin, Joliet & Eastern	500	50-ton gondola	Gen. Amer. Transp. Corp.
	500	50-ton gondola	American Car & Fdry. Co.
	200	50-ton flat	Ralston Steel Car Co.
Great Northern	1,000	50-ton box	Company shops
Inland Steel Co.	15	90-ton stake	Gen. Amer. Transp. Corp.
Monongahela Connecting	35[2]	120-ton gondola	Company shops
New York, Chicago & St. Louis	25	70-ton hopper	American Car & Fdry. Co.
Niagara Alkali Co.	10[3]	40-ton tank	American Car & Fdry. Co.
Norfolk & Western	25	70-ton hopper	Company shops
Tennessee Coal, Iron & R. R. Co.	10	70-ton ore	Company shops
U. S. Navy Dept.	10	20-ton flat	Pacific Car & Fdry. Co.
	10	40-ton box	Gen. Amer. Transp. Corp.
	12	40-ton flat	Haffner-Thrall Car Co.
U. S. War Dept.	75[1]	20-ton flat	Magor Car Corp.
	40[1]	30-ton flat	
	75[1]	20-ton gondola	
	40[1]	30-ton gondola	
U. S. Treasury Dept.	2,400[1]	Flat	Pressed Steel Car Co.
Virginian	900	55-ton hopper	Company shops
	100	55-ton gondola	
Warren Petroleum Corp.	20	50-ton tank	American Car & Fdry. Co.
Weirton Steel Co.	18	50-ton flat	Company shops

Freight-Car Inquiries

Road	No. of Cars	Type of Cars	Builder
Colorado Fuel & Iron Co.	50	70-ton gondola	....
Louisville & Nashville	1,000	Box	....
	2,100	Hopper	....
	150	Flat	....
U. S. Navy Dept., Bureau of Supplies and Accounts	10	50-ton gondola	....
U. S. War Dept.	2,000[1]	40-ton box	....
	1,500[1]	40-ton gondola	....
	350[1]	50-ton flat	....
	1,000[1]	20-ton box	....
	66[1]	20-ton caboose	....

Passenger-Car Orders

Road	No. of Cars	Type of Car	
Nashville, Chattanooga & St. Louis	1	Coach	Edw. G. Budd Mfg. Co.

Passenger-Car Inquiries

Road	No. of Cars	Type of Car	
National Rwys. of Mexico	2	Business	....
United States War Dept., Engineering Corps	3[4]	Baggage	....
	16[4]	Coach	....
	2[4]	Dining	....
	5[4]	Sleeping	....
	3[4]	Mail	....
	4[4]	Express	....
	1	Coach	....
	1	Passenger-baggage	....

[1] For export.
[2] For May, 1942, delivery.
[3] For 1942 delivery.
[4] Narrow-gage.

under priorities control since May 1, 1941, when General Metals Order No. 1 was issued. General Preference Order M-21, issued May 29, has provided overall steel control since.

Equipment Designs Limited

As a measure of conserving metals needed in the interest of national defense, J. J. Pelley, president of the Association of American Railroads, has announced for the railway industry a program which will limit the construction of new locomotives and freight cars to certain designs now in use and facilitate the allocation of steel and other materials to be used for such construction and repair purposes. The major points of the plan to which the railroads are committed with the Office of Production Management are:

1—Construction of new box, hopper, gondola, and flat cars will be limited to certain designs now in use. The proposed designs of freight cars were described in an article on page 512 of the December *Railway Mechanical Engineer*.
2—New locomotive construction will be limited to existing designs where patterns, dies, and engineering data are already available.
3—Substitution of other materials so far as possible for scarce metals in locomotive and freight-car construction.
4—Use of carbon steel rather than alloy steel in locomotive boiler construction.
5—Use of steel plates and steel sheets 48 in. wide in the construction of new freight cars instead of sizes now largely used ranging up to 119 in. in width.

Under the arrangement, car and locomotive builders will interchange plans, engineering data, and patterns which will expedite the building of railroad equipment and increase the capacity of facilities used for that purpose.

Under the agreement the use of nickel steel for locomotive bed castings, axles and rods and other moving parts both for new construction and repairs and for steel plates and rivets for repairs on existing locomotives constructed of nickel steel will continue.

In discussing locomotive needs, Mr. Pelley said: "The defense program now contemplates using facilities of the locomotive builders for production of defense material and, in order that consideration may be given to reserving sufficient capacity to meet requirements of the railroads' 1942 locomotive building program, information is desired covering requirements of each railroad.

"The suggested method contemplates an analysis of each division or district for each kind of power, freight requirements to be determined on the basis of gross ton-miles and tractive force, passenger requirements on basis of scheduled and extra movement, switch requirements on basis of assignments, and company service locomotive requirements on basis of assignments."

The railroads are also requested to inform Mr. Pelley not only as to the number of locomotives now on order, but also as to the number of additional ones which in their opinion will be necessary to meet transportation demands next year on the basis of present indications and present operating methods.

The railroads have also been asked to give attention to the possibilities of obtaining greater utilization of their locomotives by further increasing the length of runs; expediting the servicing at principal and intermediate terminals, reducing layover time so as to insure that none is allowed to stay at terminals longer than necessary; avoiding the sending of locomotives to enginehouses except for necessary repairs; centralizing running repair work, and reducing repair time by having sufficient force on hand at all times to return locomotives to service as expeditiously as possible.

OPM Organization Change

The Office of Production Management's Automotive, Transportation and Farm Equipment Branch, which handles materials for railway equipment and supplies, will hereafter report directly to OPM Director General William Knudsen and Associate Director Sidney Hillman. The branch has been under the direction of Leon Henderson, director of OPM's Division of Civilian Supply.

The change which also affects other industry branches in like manner is designed to "speed up war production." In that connection, the OPM announcement said that Messrs. Knudsen and Hillman "are calling upon all industry branch chiefs to draw more extensively upon the experience and active services of labor and management committees in meeting such problems as the maximum war use of equipment and manpower. . . ."

From the OPM Division of Priorities has come a new order with respect to repair, maintenance and operating supplies. It is known as Preference Rating Order P-100, and it takes the place of the old repair and maintenance order, P-22, which is being revoked. While many of the differences between P-100 and P-22 are technical, the OPM announcement said that some liberalization of the old plan is involved. Railroads remain among the industries eligible under the plan for priority assistance in the matter of obtaining maintenance and repair parts.

Basic Priorities Order Amended

Priorities regulation No. 1, the basic document which governs the operations of the priority system, has been amended in several important respects. It became effective December 23. Most important of the changes is a requirement that *all* orders bearing a priority rating, including B-ratings for essential civilian orders as well as A-ratings for defense orders, must be accepted by producers, in preference to any unrated order. Previously the acceptance of B-rated orders was not mandatory.

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The Office of Production Management announcement called the required acceptance of B-rated orders a further transitional step in the move toward allocation of scarce materials, since B ratings are one method of designating the relative importance of civilian uses for materials after war requirements have been met. Treatment which must be given to defense orders is clarified by a new provision which assigns a priority rating of A-10 to all defense orders not otherwise rated. This change is intended to eliminate confusion as to the handling of those defense orders which were previously unrated, in relation to other orders which had been specifically rated A-10, the lowest rating in the A series.

Section 944.14 of Priorities, Regulation No. 1 has been revised to provide a stricter limitation of inventories. Whereas producers were previously forbidden to increase their inventories beyond the amount necessary to meet required deliveries of their products, they are now forbidden to accept delivery of materials for inventory in excess of a practicable working minimum. The prohibition applies to suppliers of materials for inventory as well as to producers who maintain inventories, and it covers non-defense as well as defense producers. An exception is made, however, for inventories of materials imported from foreign countries. Also, there is a provision that no material may be fabricated, processed, alloyed or otherwise altered if the producer's inventory of the material in its altered form would thereby be increased beyond a practicable working minimum, unless specific authorization is granted by the director of priorities.

Another amendment is designed to help prevent receipt of a new, high-rated order from interfering with fulfillment of the delivery date on a previously accepted lower-rated order. Unless the new order bears an AA rating or is accompanied by specific direction from the director of priorities, it will not have to be accepted if its acceptance would necessitate preempting material which has already been completed to fill a previously accepted defense order which bears a lower rating, or if it would preempt material which is within 15 days of completion. Or, if the new order is accepted, the producer may not divert material already completed or about to be completed on a previous defense order for use in filling the new order.

Equipment Purchasing and Modernization Programs

Canadian National.—The Canadian National has authorized the purchase of 415 40½-ft. box cars of 40 tons' capacity.

Chicago & North Western.—The C. & N. W. has requested authority from the Interstate Commerce Commission to assume liability for $3,800,000 of equipment trust certificates, maturing in 10 equal annual installments of $380,000 on January 1 in each of the years from 1943 to 1952, inclusive. The proceeds will be used as part of the purchase price of new equipment costing a total of $5,125,000, and consisting of 1,375 50-ton, 40 ft. 6 in., all-steel box cars, and 250 70-ton steel iron ore cars.

Chicago, Rock Island & Pacific.—The Rock Island has been given permission by the district court to purchase $4,190,000 of equipment, including 12 Diesel-electric switching and 5 Diesel-electric road locomotives, and 850 freight cars.

Missouri Pacific.—The Missouri Pacific has been authorized by the district court to spend $204,000 for the acquisition of 17 parlor cars and their conversion into coaches. The cars will be purchased from the Pullman Company.

New York, New Haven & Hartford.—The New Haven has applied to the Interstate Commerce Commission for authority to assume liability for $2,940,000 of equipment trust certificates, the proceeds of which will finance about 80 per cent of the price of equipment expected to cost a total of $3,675,000. The equipment includes five electric freight locomotives; 10 2,000-hp. Diesel-electric "A" unit passenger and freight locomotives, which will ordinarily be operated in pairs, and 50 steel cabooses. The certificates, to be issued at a rate determined from competitive bids, will be dated February 1, 1942, and will mature in equal annual installments of $294,000 on February 1 of each year from 1943 to 1952, inclusive.

Pennsylvania.—The Pennsylvania has asked authority from the Interstate Commerce Commission to assume liability for $18,465,000 of equipment trust certificates, maturing in equal annual installments of $1,231,000 on January 1 in each of the years from 1943 to 1957, inclusive. The proceeds of the issue will be used as part of the purchase price of new equipment costing a total of $23,081,250. The new equipment, which will be constructed in the company's own shops, will consist of the following: 2,000 all-steel box cars; 2,700 all-steel hopper cars; 500 all-steel, mill-type, G-27 gondola cars; 500 all-steel, mill-type, G-29 gondola cars; 300 all-steel covered hopper cars; 10 all-steel, heavy duty flat cars; 10 all-steel, heavy duty well cars; 50 all-steel cabin cars; 12 steam locomotive tenders; and 15 electric passenger locomotives.

The Pennsylvania will also air-condition, renovate and completely modernize 100 additional passenger coaches at a cost of approximately $3,500,000, as part of its continuing program for the improvement of its passenger-train equipment. The work will be carried out in the railroad's own shops at Altoona, Pa., and is expected to be completed so as to have the cars available for use in the summer of 1942. The first deliveries are scheduled for about the middle of April.

Fifty of the hundred additional cars will be adapted to long-distance service, and will be equipped with reversible and adjustable reclining seats and spacious luggage compartments for the storage of heavy and bulky baggage on extended journeys. The cars will have a seating capacity of 68 passengers each. Ten other cars will be of the combined passenger-baggage type, with similar reversible seats for 36 in the passenger compartment. They will also be used in long-distance trains. Both the full length and combination cars will be streamlined.

For use in the high-speed electrified service between New York, Philadelphia, Pa., Baltimore, Md., and Washington, D. C., 30 cars will be equipped with high back rubber-cushioned reversible seats for 80 passengers each, while ten will be combined passenger-baggage cars with similar seating accommodations for 40 passengers.

All of the cars to be renovated and modernized will be equipped with tight-lock couplers and rubber draft gears, wide windows of double glass, insulation against heat and cold, and the new roller-bearing cast-steel side frame trucks.

St. Louis-San Francisco.—The Frisco has asked the district court for permission to spend $4,302,569 during 1942, of which $2,478,267 will be expended on roadbed repairs and replacements and the balance for improvements to equipment. The company plans to convert 400 freight cars and to enlarge its station at Newburg, Mo., where the patronage of soldiers from Ft. Leonard Wood has increased passenger revenues from $26,569 during the first nine months of 1940 to $2,370,128 for the same period this year.

Seaboard Air Line.—Division 4 of the Interstate Commerce Commission has modified its order of November 4, so as to grant authority to this company to issue and sell $2,448,000 of 2½ per cent equipment trust certificates to the Reconstruction Finance Corporation. Originally, the company was authorized to sell $3,552,000 of certificates, but due to the fact that it was unable to procure the delivery of three Diesel-electric freight locomotives from the Electro-Motive Corporation, it decided to reduce the amount of the issue by $1,476,701. As a result, the total cost of the equipment was cut from $4,838,479 to $3,361,778. Details of the original application were given on page 501 of the November issue.

Southern Pacific.—This company has asked the Interstate Commerce Commission for authority to assume liability for $4,430,000 of 2½ per cent equipment trust certificates, maturing in 10 equal annual installments of $443,000 on January 1 in each of the years from 1943 to 1952, inclusive. The proceeds will be used as part of the purchase price of new equipment costing a total of $5,563,681 and consisting of 700 steel sheathed, wood-lined box cars; 700 all-steel, drop bottom gondola cars; 150 70-ton Hart Selective hopper bottom steel ballast cars; 100 12,500 gallon steel tank cars; 100 12,500 gallon steel tank cars with heater coils; and 50 8,000 gallon steel tank cars with heater coils.

Wabash.—The Wabash has been authorized by the district court to spend $240,000 for three Diesel-electric locomotives.

Wheeling & Lake Erie.—This company has asked the Interstate Commerce Commission for authority to assume liability for $1,050,000 of equipment trust certificates, maturing in equal annual installments on January 1 in each of the years from 1943 to 1952, inclusive. The proceeds will be used as a part of the purchase price of new equipment costing a total of $1,504,372 and consisting of 10 2-8-4 freight locomotives which will be built by the American Locomotive Company.

Supply Trade Notes

International Nickel Company.—*W. J. Calnan, H. D. Tietz,* and *E. A. Turner* have been appointed assistants to the sales manager of the International Nickel Company.

◆

J. V. Freeman has been appointed assistant to the vice-president in charge of coke by-products' sales of all subsidiaries of the United States Steel Corporation with offices at 71 Broadway, New York.

◆

The Whitcomb Locomotive Company has awarded a contract for a one-story factory addition to its plant at Rochelle, Ill., to the E. L. Hallbauer Construction Company. The cost is about $50,000.

◆

Lukenweld, Inc.—*William S. Wilbraham,* manager of sales of Lukenweld, Inc., Coatesville, Pa., has been promoted to manager of costs, and *Robert C. Sahlin,* assistant manager of sales has become manager of sales.

◆

P. S. Nash, assistant vice-president of railroad sales of the Union Asbestos & Rubber Company, Chicago, has been elected vice-president with headquarters at San Francisco, Cal.

◆

Carboloy Company, Inc.—The sales engineering department of the Carboloy Company has been centralized under the direction of *K. R. Beardslee,* sales manager. Martin Muhling, former special engineering executive and Earl Glen, formerly the representative of Carboloy in Pittsburgh, Pa., have been appointed to the newly created positions of assistant sales manager.

◆

Carnegie-Illinois Steel Corp.—*F. R. Gammon* has been appointed manager of sales of the New York district sales office of the Carnegie-Illinois Steel Corporation to succeed *James R. Mills,* who has retired. Mr. Gammon joined the sales force of the Carnegie-Illinois Steel Corporation as special representative in 1936, and on January 1, 1938, was made manager of sales in Cleveland, Ohio, which position he now relinquishes.

◆

The Carnegie-Illinois Steel Corporation, subsidiary of the United States Steel Corporation, has begun work on a $15,000,000 expansion program to provide increased steel and iron making capacity at its Gary, Ind., steel works. Construction will include a new open-hearth furnace, the rebuilding and enlargement of a blast furnace, installation of greater soaking pit capacity, the rebuilding of a battery of coke ovens, and provision for additional ore unloading facilities.

Obituary

Luman R. Dewey, for many years associated with the American Brake Shoe & Foundry Co. until his retirement in 1933, died December 6, at his home in Cattaraugus, N. Y. He was 79 years of age. Mr. Dewey joined the American Brake Shoe & Foundry Co. in 1905 and was appointed western sales manager in 1917, serving in that capacity until his retirement.

◆

Clifford S. Stillwell, executive vice-president of the Warner & Swasey Co., Cleveland, Ohio, and president of the National Machine Tool Builders Association, died of a heart ailment on November 19.

◆

Cleon Melvin Hannaford, sales engineer of the Wine Railway Appliance Division, Unitcast Corporation, died December 8 after a brief illness. He was 50 years of age. Mr. Hannaford began his career in 1913 with the Baltimore & Annapolis as a blue print machine operator, tracer and draftsman, and from 1917 to 1922, served as a draftsman with the Chesapeake & Ohio. He was president of the Car Devices Company, Inc., and sales representative, Railway Supply Company, Richmond, Va., from 1923 to 1936. He became associated with the Wine Railway Appliance Division as sales engineer in 1936. During his career, Mr. Hannaford invented numerous railway mechanical devices.

◆

William H. Winterrowd, vice-president in charge of operations and a director of the Baldwin Locomotive Works, with headquarters at Eddystone, Pa., died suddenly on December 7 in the Bryn Mawr hospital at the age of 57, following injuries sustained in an automobile accident several days previously. Mr. Winterrowd, who was born in Hope, Ind., on April 2, 1884, attended the schools in that city and in 1907 was graduated from Purdue University with the degree of B. S. in mechanical engineering. During his summer vacations he worked as a locomotive wiper on the Missouri Pacific, a blacksmith helper on the Lake Erie & Western, and as a car and airbrake repairman on the Pennsylvania, Lines West of Pittsburgh. Following his graduation he entered the service of the New York Central as a special apprentice and shortly thereafter became assistant to the mechanical engineer at Cleveland, Ohio. In 1912, Mr. Winterrowd went to the Canadian Pacific as mechanical engineer, and in 1915 became assistant chief mechanical engineer. During the World War, after converting part of the railroad's largest shop into a munitions plant, he went to Russia with Sir George Bury, vice-president of the Canadian Pacific, as a member of Lord Milner's mission. Upon his return in 1918, he was appointed chief mechanical engineer of the C. P. R. Mr. Winterrowd joined the Lima Locomotive Works, Inc., in 1923, as assistant to the president and in 1927 was elected a vice-president of that company. In 1934 he became vice-president of the Franklin Railway Supply Company, which position he left in 1939 to become vice-president in charge of operations of the Baldwin Locomotive Works. In this capacity he directed the production, not only of locomotives, but also of the many items of ordnance material being manufactured by Baldwin, including medium and heavy tanks. In 1936 Mr. Winterrowd was given the degree of doctor of engineering by Purdue University. At the time of his death he was president of the Purdue Alumni Association.

W. H. Winterrowd

He was a life member of the Mechanical Division of the A. A. R.; a member of the Railway Fuel & Traveling Engineers' Association, and a member of many railway clubs. He was past chairman of the Railroad Division and of the Publications Committee of the A. S. M. E. For the past three years he had served as a manager and for the past two years as a member of the Executive Committee of the society and had just been elected a vice-president. He had membership in the Newcomen Society, and was on the Board of Managers of the Franklin Institute. Mr. Winterrowd was the author of a number of papers dealing with railway operation and motive-power and rolling-stock design and operation.

◆

William R. Gillies, vice-president of the Union Asbestos & Rubber Co., with headquarters at San Francisco, Cal., died on November 24. Mr. Gillies was born at Vincennes, Ind., on October 25, 1879. He entered railway service in 1914 in the mechanical department of the Oregon Short Line and in 1916 was promoted to mechanical engineer. He resigned from this position in 1919 to become assistant to the president of the Union Asbestos & Rubber Co., with jurisdiction over the development of products and sales. In 1922, he was elected vice-president in charge of western railroad sales and in November, 1939, was placed in charge of production, engineering and research, with headquarters at Cicero, Ill. In the following year he transferred his headquarters to San Francisco.

(Turn to second left-hand page)


Power
15 GM DIESELS
replace
STEAM SWITCHERS
on the
GRAND TRUNK WESTERN
GENERAL MOTORS
LOCOMOTIVES

Personal Mention

General

George H. Emerson, chief of motive power and equipment on the Baltimore & Ohio with headquarters at Baltimore, Md., has retired.

J. J. Tatum, assistant chief of motive power and equipment on the Baltimore & Ohio with headquarters at Baltimore, Md., has retired.

F. H. Einwaechter, Jr., assistant engineer in the locomotive department on the Baltimore & Ohio, has become mechanical engineer, at Baltimore, Md.

W. B. Whitsitt, assistant chief of motive power and equipment on the Baltimore & Ohio with headquarters at Baltimore, Md., has been appointed chief engineer of motive power and equipment in charge of research, design, standards and new construction at Baltimore.

Howard Hill, master mechanic of the Philadelphia division on the Reading at Philadelphia, Pa., has become assistant superintendent of motive power and rolling equipment at Reading, Pa.

A. K. Galloway, superintendent of motive power and rolling equipment on the Reading at Reading, Pa., has become general superintendent of motive power and equipment on the Baltimore & Ohio with headquarters at Baltimore, Md.

G. H. Massy, division master mechanic in charge of the central and southern subdivisions on the Central of New Jersey at Jersey City, N. J., has become assistant superintendent of motive power and rolling equipment at Elizabethport, N. J.

Ernest P. Gangewere, assistant superintendent of motive power and rolling equipment on the Reading with headquarters at Reading, Pa., has been appointed superintendent of motive power and rolling equipment of the Reading and the Central of New Jersey, with the same headquarters.

William Moore, shop superintendent of the Hornell back shop of the Erie at Hornell, N. Y., has been promoted to the position of assistant to the superintendent of motive power, with headquarters at Cleveland, Ohio.

R. G. Webb, assistant superintendent on the Chicago, Milwaukee, St. Paul & Pacific at Lewistown, Mont., has been appointed superintendent of air brakes, with headquarters at Milwaukee, Wis., a newly created position.

J. E. Goodwin, master mechanic on the International-Great Northern (part of the Missouri Pacific lines), with headquarters at San Antonio, Tex., has been appointed to mechanical superintendent, Southern district, of the Missouri Pacific, with headquarters at St. Louis, Mo. A photograph and sketch of Mr. Goodwin appeared on page 11 of the May, 1941, *Railway Mechanical Engineer*.

J. M. Nicholson, general assistant, mechanical department, Atchison, Topeka & Santa Fe, has been promoted to assistant to the operating vice-president (mechanical), with headquarters as before at Chicago, succeeding John Purcell, who retired on January 1. A photograph and biography of Mr. Nicholson were published in the *Railway Mechanical Engineer* of August, 1941.

John Purcell, assistant to the operating vice-president (mechanical) of the Atchison, Topeka & Santa Fe, retired on January 1, after 57 years of service. Mr. Purcell was born at St. Charles, Mo., on January 19, 1870, and entered railroad service on October 3, 1884, as a machinist apprentice on the Santa Fe. He was advanced to gang foreman in 1887, and then served in various positions until about 1898 or 1899 when he was appointed master mechanic at Argentine, Kan. He was later transferred to Shopton, Ia., and in April, 1902, was promoted to superintendent of the Topeka shops. In May, 1912, he was further advanced to assistant to the operating vice-president (mechanical), with headquarters at Chicago, continuing in that position until his retirement, except during the period of federal control, when

J. Purcell

he was assistant to the federal manager of the Santa Fe. Mr. Purcell is a life member of the Mechanical division of the Association of American Railroads. He served as chairman of that division in 1923 and 1924 and has been a member of its General committee since 1920 and of its Committee on Research since 1933. He also served from 1914 to 1919 as a member of the Executive committee of the former American Railway Master Mechanics' Association, as a member of the Committee on Standards for Locomotives and Cars of the U. S. Railroad Administration in 1918 and as a member of the Mechanical Advisory committee under the Federal Co-ordinator of Transportation in 1934.

In 57 years of experience, all on one road, Mr. Purcell demonstrated those rare executive qualities resulting in his rapid rise to head the mechanical department of the Santa Fe, and also enabling him to assume leadership in the effective work which the A. A. R., Mechanical Division, has done throughout the years to further mechanical progress on all roads. Mr. Purcell's achievements in the mechanical field have been recognized by his election to membership in the American Society of Mechanical Engineers.

A diminutive Irishman, aggressive, impulsive and famous for his linguistic powers, John Purcell is perhaps best known as an organizer and developer of men, many of whom, on the Santa Fe and other roads, are products of the apprentice training course which he was an important factor in founding and bringing to its present state of efficiency. In his own early days, Mr. Purcell is said to have participated in many scrapes, as well as scraps. Knowing young men as he does, he has not only insisted on hard work and rigid discipline, but tempered his decisions with justice and kindness. At an anniversary dinner, held in the big auditorium of the motive power building at Topeka, Kan., in 1937, and largely attended by Santa Fe officers and mechanical department employees, Mr. Purcell was toasted as a "Maker of Men," the "Man who invented work" and "Our best friend."

Throughout the years, Mr. Purcell's major interest in life has been "railroading," but he has always found time to take an active interest in public affairs and, in times of emergency, like the Topeka flood in 1903, he gave all of his energy and talents to organizing relief. His contributions to public welfare and his personal charities to young men and friends, both inside and outside the Santa Fe organization, are as widely distributed as they are little known.

Edred B. Hall, chief mechanical officer of both the Chicago & North Western and the Chicago, St. Paul, Minneapolis & Omaha, retired on December 1. Mr. Hall was born at Parkersburg, Iowa, on December 1, 1870, and entered railway service in July, 1889, as a shop and enginehouse mechanic on the C. & N. W. at Hawarden. In 1892, he became a locomotive fireman and, in 1898, was promoted to locomotive engineman. On September 23, 1907, Mr. Hall became road foreman of engines at Sioux City, Iowa, and on March 1, 1910, master mechanic on the Northern Iowa and Sioux City division, with headquarters at Eagle Grove, Iowa. On May 1, 1912, he was transferred to the Wisconsin division, with headquarters at Chicago, and in December, 1914, was promoted to the position of assistant to the general superintendent of motive power and machinery at Chicago, handling labor matters. In 1917, Mr. Hall was appointed assistant superintendent of the Milwaukee division, with headquarters at Milwaukee, Wis.; in 1919, assistant superintendent of motive power and machinery, with headquarters at Chicago; on May 1, 1922, superintendent

of motive power and machinery, and in September, 1927, general superintendent of motive power and machinery. He was appointed also general superintendent of motive power and machinery of the Omaha in 1929, and in August, 1939, became chief mechanical officer of both roads. Mr. Hall

Edred B. Hall

was president of the Western Railway Club in 1921-1922, was chairman of the Mechanical division of the Association of American Railroads in 1934-1935, and in 1932 was chairman of the General committee of the A. A. R., Mechanical division, of which committee he is still a member.

HARRY P. ALLSTRAND, assistant to the chief executive officer of the Chicago & North Western, has been appointed chief mechanical officer, with headquarters as before at Chicago. Mr. Allstrand was born at Council Bluffs, Iowa, on September 8, 1885, and graduated from Iowa State College in 1913. He entered railway service in 1903 as a machinist apprentice on the C. & N. W. at Missouri Valley. In 1907,

Harry P. Allstrand

he became a machinist and, later, foreman at Missouri Valley. In 1909, he left railway service to attend college at Ames, Iowa, returning to the North Western after graduation in 1913, as an enginehouse foreman at Clinton, Iowa, later being transferred to South Pekin, Proviso, Ill., and East Clinton, Iowa. Mr. Allstrand became division foreman at Chadron, Neb., in 1918, and in 1919 was promoted to assistant master mechanic. He later served as master mechanic at Chadron and at Eagle Grove, Iowa, Belle Plaine and Boone. In 1924, he was appointed efficiency supervisor, with headquarters at Chicago, and in 1926, became assistant superintendent of motive power and machinery, with the same headquarters. Mr. Allstrand was appointed principal assistant superintendent of motive power and machinery in 1929, and assistant to the chief executive officer in August, 1939. Mr. Allstrand was president of the Western Railway Club in Chicago, in 1929-30. He is vice-chairman of the A. A. R. Mechanical division Committee on Locomotive Construction and has recently been elected to membership on the Executive Committee of the A. S. M E., Railroad division.

PAUL O. CHRISTY, superintendent of equipment on the Illinois Central at Chicago, has been appointed general superintendent of equipment, with the same headquarters, succeeding his brother, G. C. Christy, who has retired because of ill health. A photograph and biography of Paul O. Christy were published in the April, 1941, issue of the *Railway Mechanical Engineer*, following his appointment to the position of superintendent of equipment.

G. C. CHRISTY, general superintendent of equipment on the Illinois Central at Chi-

G. C. Christy

cago, has retired because of ill health. Mr. Christy was born at Holly Springs, Miss., in 1884, and entered railway service as a helper in the paint shop of the Illinois Central at Water Valley, Miss., in 1898, while on vacation from school. Two years later he was transferred to the machine shop as an apprentice and upon the completion of his apprenticeship in March, 1904, he served until 1911 as a machinist and a foreman. In October of the latter year he became general foreman at Water Valley and in December, 1914, was transferred to McComb, Miss. Mr. Christy was promoted to master mechanic of the Greenville and New Orleans division, with headquarters at Vicksburg, Miss., in July, 1917, and in 1926, his jurisdiction was extended to include the Vicksburg Route division. On November 1, 1929, he was appointed superintendent of the car department, with headquarters at Chicago; on November 1, 1937, superintendent of motive power, and in March, 1939, he was appointed general superintendent of equipment.

Master Mechanics and Road Foremen

H. T. SNYDER, master mechanic on the Union Pacific at Cheyenne, Wyo., has been transferred to Kansas City, Kans.

W. L. JONES, master mechanic on the Illinois Central at Champaign, Ill., has been transferred to Jackson, Tenn.

L. A. ALLARD, assistant master mechanic on the Missouri Pacific at Kansas City, Mo., has been appointed master mechanic of the Joplin, White River, Wichita divisions, with headquarters at Nevada, Mo.

Shop and Enginehouse

G. R. SEITZ has been appointed shop superintendent of the back shop of the Erie at Hornell, N. Y.

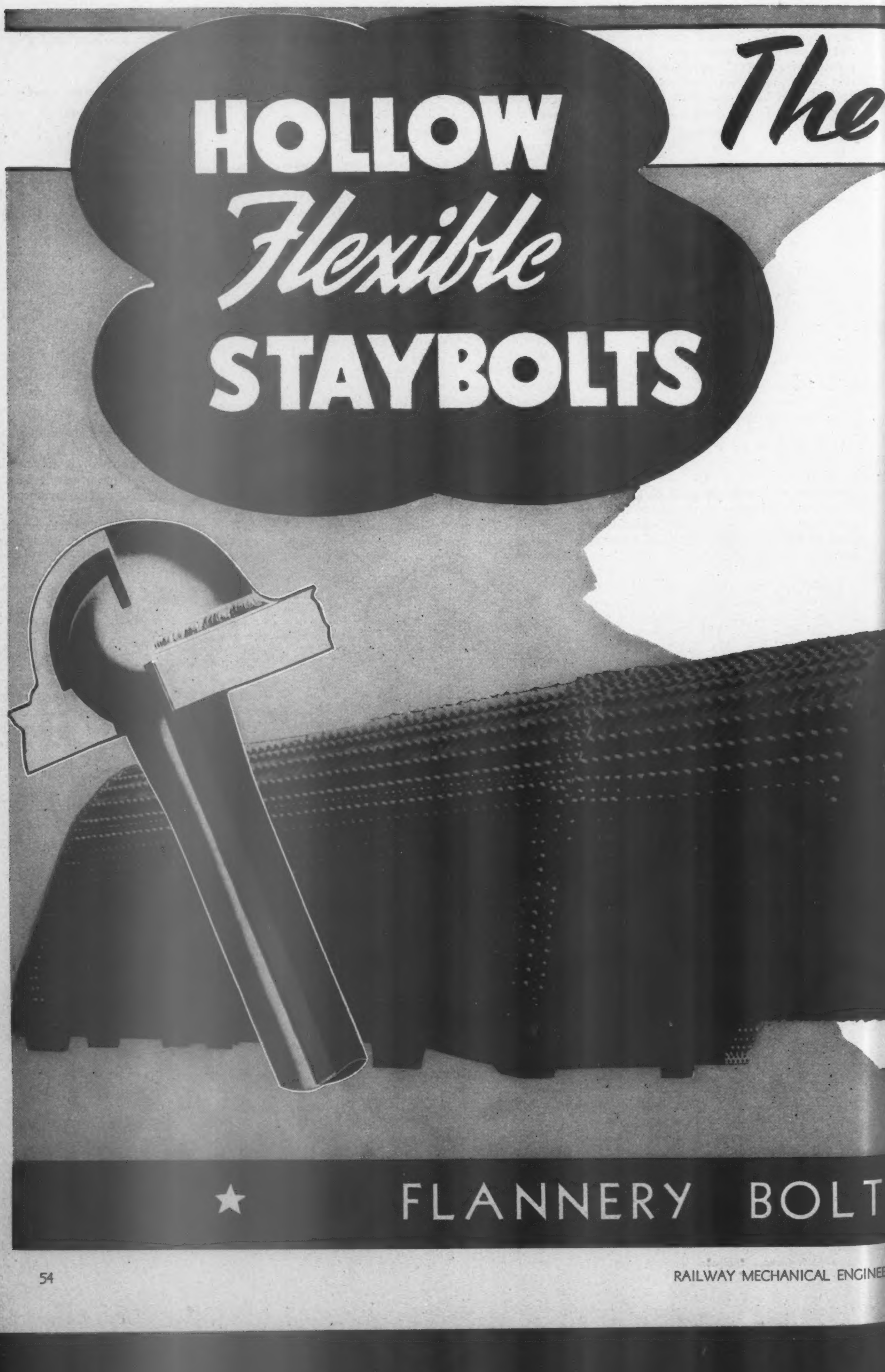
WALTER R. SEDERQUEST, master mechanic of the Boston (Mass.) division on the New York, New Haven & Hartford, who has been appointed superintendent of the Readville (Mass.) shops, as announced in the November issue, was born on March 24, 1888, at Greely, Colo. Mr. Sederquest attended grammar school and a school of mechanical arts, and entered railway service in October, 1904, with the Boston & Maine. On January 13, 1907, he became a machinist on the New Haven at Boston, and in November, 1911, was promoted to the position of foreman. He became general foreman at New Haven, Conn., on March 1, 1916, and master mechanic on the Old Colony division at Taunton, Mass., on December 15, 1923. On February 15, 1929, Mr. Sederquest was transferred to the Midland division, with headquarters at Boston where he continued as master

W. R. Sederquest

mechanic through the consolidation in 1931 of the Midland, Old Colony and Boston divisions into the Boston division.

Obituary

C. W. COOK, master mechanic for the Seaboard at Atlanta, Ga., died on December 19.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